NUCLEAR SCIENCE ABSTRACTS

Volume 11 August 15, 1957 No. 15

GENERAL

ATOMIC BOMBS AND WARFARE

7905
LARGE EXPLOSIONS AND ATMOSPHERIC PHENOMENA. A. Kh. Khrgian (Moscow Lomonosov State Univ.) Priroda, 46, No. 3, 31-7(1957) Mar. (In Russian)

A review is given of data on the effects of large atomic and thermonuclear explosions on the weather conditions. (R.V.J.)

RESEARCH PROGRAMS

7906 NP-6321
Joint Establishment for Nuclear Energy Research, Kjeller, Norway.
FIFTH ANNUAL REPORT, JULY 1955–JUNE 1956 OF THE DUTCH–NORWEGIAN. Jan. 1957. 36p.

The work of JENER for 55-56 is summarized including the operation and improvement of JEEP, isotope shipments, chemistry and physics research, and construction. The power reactor is under construction and a reactor school has been started. (For previous period see NP-5983.) (M.H.R.)

BIOLOGY AND MEDICINE

7907
INVESTIGATIONS ON THE METABOLISM OF FLUORIDE. IV. FLUORIDE BALANCE STUDIES AT HIGH LEVELS OF INTAKE IN RABBITS. Dwight E. Gardner, Thomas G. Scharff, Frank A. Smith, and Harold C. Hodge (Univ. of Rochester, N. Y.). J. Nutrition 61, 207-17(1957) Feb.

RADIATION EFFECTS

7908 AF-SAM-57-15
Texas. Univ., Galveston. Tissue Culture Lab.
OBSERVATIONS ON TISSUES FROM THE MONKEY HEAD IN CELL CULTURES WITH SPECIAL REFERENCE TO RADIATION EFFECTS. C. M. Pomerat and W. Hild. July 9, 1956. 32p.

7909 AF-SAM-57-47
Utah. Univ., Salt Lake City. Coll. of Medicine.
EFFECT OF X-RADIATION ON SUSCEPTIBILITY TO INFECTION FOLLOWING ORAL CHALLENGE IN IMMUNIZED AND NON-IMMUNIZED MICE. Eugene H. Perkins and Stanley Marcus. Sept. 20, 1956. 7p.

7910 ANL-5696
Argonne National Lab., Lemont, Ill.
BIOLOGICAL AND MEDICAL RESEARCH DIVISION QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1956. Mar. 1957. 122p. Contract W-31-109-eng-38. $0.60(OTS).

Progress is reported in the following studies: measurements of antigenic specificity; the growth of mouse ascites tumor after serial transfer in rats; the effect of injected Y^{90} on the growth of ascites carcinoma in the mouse; the control of the mange mite on mice and dogs; the pathological effects of injected Sr^{90} in dogs and cats; factors influencing the formation of co-enzymes; the effects of x irradiation on blood volume and activity of the hematopoietic system in chicks; information content and biotopology of the cell in terms of cell organelles as observed in Paramecium; the association of liver catalase with uricase-containing particulates in rats and mice; effects of irradiation on spermatogenesis in grasshoppers; hyperpigmentation induced in the appendages of mice by exposure to γ radiation; the toxic effects of D_2O in mice and rats; the course of deuteration of mice drinking deuterated water; the effects of deuteration on the growth of ascites tumors in mice; the influence of paired doses of Co^{60} γ radiation on recovery from radiation injury; the survival of the four-day chick embryo following irradiation with fission neutrons; metabolism of organic acids by Spirillum serpens; the relationship of flick phosphene to eye phenomena; the metabolism of Ca^{45} and Sr^{90} in fish; the lack of protective effects of isomers of phenergan against radiation lethality in mice; the calibration of a combination electronic cell counter and size distribution analyzer used in classification of tumor cells in suspension; the biosynthesis of C^{14}-labeled reserpine and C^{14}-labeled gibberellins; the metabolic relation between adenine and sulfur amino acids in yeast; and tracer studies on arginine metabolism in rat livers. (For preceding period see ANL-5655.) (C.H.)

7911 UCRL-3746
California. Univ., Berkeley. Radiation Lab.
ULTRAVIOLET-INDUCED BIOCHEMICAL MUTANTS OF SACCHAROMYCES CEREVISIAE. Robert K. Mortimer, Ruth S. Lerner, and June K. Barr. Apr. 5, 1957. 10p. Contract W-7405-eng-48. $0.25(OTS).

7912
EFFECTS OF IONIZING RADIATION UPON THE ACTIVITY OF DIGESTIVE ORGANS IN DOGS Yu. N. Uspenskiĭ (Astrakhan Medical Inst.). Fiziol. Zhur. S.S.S.R. 43, 328-35(1957). (In Russian)

7913
SENSITIVITY OF IRRADIATED ANIMALS TO THE PATHOGENIC ANAEROBS AND EFFECTIVENESS OF SULFUR PROPHYLACTICS ON THE ANAEROBIC INFECTIONS DURING RADIATION INJURIES. R. V. Petrov. Med. Radiol. 2, No. 2, 60-5(1957) Mar.-Apr. (In Russian)

7914
THE EFFECTS OF FRACTIONATED DOSES OF X-RAYS ON DORMANT BARLEY SEEDS. A. B. Schooler (North Dakota State Coll., Fargo), R. A. Nilan (State Coll. of Washington, Pullman), and L. L. Phillips (North Carolina State Coll., Raleigh). Northwest Sci. 31, No. 2, 80-91 (1957).

7915
SPLEEN DPNH CYTOCHROME c REDUCTASE ACTIVITY IN X-IRRADIATED RATS. Herbert J. Eichel (Hahnemann Medical Coll., Philadelphia). Proc. Soc. Exptl. Biol. Med. 95, 38-43(1957) May.

7916
EFFECT OF X IRRADIATION ON INCREASE IN RAT LIVER TRYPTOPHAN PEROXIDASE PRODUCED BY ADRENAL STEROIDS. John F. Thomson and Florence J.

Klipfel (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 95, 107-8(1957) May.

7917
EFFECTS OF LOW DOSES OF X-RAYS ON EMBRYONIC DEVELOPMENT IN THE MOUSE. Laine Brauch Russell (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 95, 174-8(1957) May.

RADIATION HAZARDS AND PROTECTION

7918 AECU-3494
Sandia Corp., Albuquerque, N. Mex.
THE PROBABILITY DISTRIBUTION OF FALLOUT PATTERNS DUE TO WIND VARIABILITY. T. E. VanZandt. Mar. 1, 1957. 10p. Contract AT(29-1)-789. (TM-118-57-51). $1.80(ph OTS); $1.80(mf OTS).

Equations are derived for the probability of a point receivirg greater than a specified dose, when the predicted fall-out pattern and wind variability are given. (auth)

7919 AMRL-262
Army Medical Research Lab., Fort Knox, Ky.
THE PROTECTIVE EFFECT OF SODIUM DIPHENYLHYDANTOIN IN THE HYPERACUTE RADIATION SYNDROME. Robert D. Laird and Robert L. Fonner. Aug. 22, 1956. 16p. Project No. 6-59-08-014.

Administration of sodium diphenylhydantoin (Dilantin^{R}) to CF_1 mice prior to exposure to 250 KVP x rays controlled convulsive activity and increased median survival time several-fold between 55,000 and 150,000 r. Control by Dilantin^{R} was measured by decrease in the incidence and severity of convulsions and delay in onset of the convulsive phase. The results obtained with diphenylhydantoin suggest that convulsive activity which arises in experimental animals after exposure to massive doses of radiation either or iginates in or is mediated through the motor cortex of the cerebrum. (auth)

7920 KAPL-1313
Knolls Atomic Power Lab., Schenectady, N. Y.
RADIOLOGICAL DEVELOPMENT ACTIVITIES IN THE HEALTH PHYSICS UNIT. Semiannual Progress Report [for] July–December 1954. Changed from OFFICIAL USE ONLY June 3, 1957. 26p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Data are presented from studies on the efficiency of air-cleaning filter materials and air-cleaning equipment. An illustrative schematic is presented of an extrapolation chamber and auxiliary components constructed for use in the determination of surface dose-rates from β sources. A radioactive gas counting system for the detection of A^{39} was calibrated. Resonance and threshold detector foils of In and S were tested for use in personnel neutron dosimetry under both normal and emergency conditions in reactor areas. The preparation of β sources is described. A method is outlined for the determination of Ra^{226} in urine. Liquid waste studies were confined to an analysis of P^{32} activity collected on suspended Mohawk River sediment. (C.H.)

7921 NAA-SR-1645
Atomics International Div., North American Aviation, Inc. Canoga Park, Calif.
HEALTH PHYSICS TRAINING COURSE. A. Jarrett. June 1, 1957. 63p. Contract AT-11-1-GEN-8. $0.40(OTS).

7922 WT-1218
Sandia Corp., Albuquerque, N. Mex. and Federal Civil Defense Administration, Battle Creek, Mich.
EVALUATION OF VARIOUS TYPES OF PERSONNEL SHELTERS EXPOSED TO AN ATOMIC EXPLOSION. L. J. Vortman. May 1956. 122p. Projects 34.1 and 34.3 [of] OPERATION TEAPOT. $1.10(OTS).

7923
EFFECTS OF RADIATION ON MAMMALS. V. P. Bond and E. P. Cronkite (Brookhaven National Lab., Upton, N. Y.). Ann. Rev. Physiol. 19, 299-328(1957).

A survey was made of the literature from June 1953 to July 1956 covering modification of radiation effects by chemical and biological means, and post-irradiation restoration of tissues. 230 references. (C.H.)

7924
PREVENTING INJURY FROM RADIATION. John R. Hall (Office of the Surgeon General, Department of the Army). Public Health Repts. (U.S.) 72, 426-30(1957) May.

RADIOGRAPHY

7925 CF-57-2-2
Oak Ridge National Lab., Tenn.
METHODS OF COLLECTION, PREPARATION AND SPECTROGRAPHIC ANALYSIS OF HUMAN TISSUES. I. H. Tipton, M. J. Cook, R. L. Steiner, J. M. Foland, K. K. McDaniel, and S. D. Fentress. Feb. 28, 1957. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

TRACER APPLICATIONS

7926
RADIOISOTOPES IN A SIMPLIFIED TECHNIC FOR ACCURATE DETERMINATION OF BLOOD VOLUMES. Edmund A. Smolik, Raymond O. Muether, Francis P. Nash, and Wilfred Konneker (St. Louis Univ. School of Medicine, Mo., Neurosurgical Services of City, County, St. Louis, Mo., and DePaul Hospitals, St. Louis, Mo.). Am. J. Clin. Pathol. 26, 1127-32(1956) Oct.

7927
THE RADIOACTIVE PHOSPHORUS UPTAKE TEST FOR MALIGNANT MELANOMA OF THE EYE. Anthony Donn and John W. McTigue. Arch. Ophthalmol. (Chicago) 57, 668-71(1957) May.

7928
FUNDAMENTAL LIMITATIONS OF RADIOPHOSPHORUS COUNTING METHODS USED FOR DETECTION OF INTRAOCULAR NEOPLASM. James F. O'Rourke, Humphrey Patton, and Robert Bradley. Arch. Ophthalmol. (Chicago) 57, 730-8(1957) May.

7929
STRONTIUM^{85} AND CALCIUM^{45} METABOLISM IN MAN. Herta Spencer, Daniel Laszlo, and Milton Brothers (Montefore Hospital, New York). J. Clin. Invest. 36, 680-8(1957) May.

CHEMISTRY

7930 CCC-1024-TR-238
Kansas. Univ., Lawrence.
MECHANISM STUDIES OF THE OXIDATION OF TRIALKYL BORANES. C. A. VanderWerf, W. E. McEwen, and C. McMillin. Apr. 24, 1957. 23p. For Callery Chemical Co. Contract [NOa(s)-52-1024-c].

A study was made of the oxidation of trialkyl boranes, and attempts were made to establish a mechanism for this type of reaction. Carbon tetrachloride, $CHCl_3$, $CHBr_3$, $C_6H_5CH_3$, and cumene were used as solvents for the oxidation of tri-n-propylborane and tri-n-pentylborane to substantiate the existence of free radicals. Products which resulted from the dimerization, the disproportionation, and the reaction with the solvent of the n-propyl and the n-pentyl radicals were isolated from the reaction mixtures

of the respective alkyl boranes. The results indicated that the mechanism for the cleavage of the carbon-boron bond must involve the formation of a free alkyl radical. A detailed mechanism consistent with all the known facts concerning the oxidation of trialkyl boranes is presented. (auth)

7931 KAPL-1456

Knolls Atomic Power Lab., Schenectady, N. Y.

INVESTIGATION OF RADIOACTIVE DECONTAMINATION METHODS FOR SODIUM REACTOR SYSTEM COMPONENTS. F. G. Haag. Dec. 1, 1955. Changed from OFFICIAL USE ONLY June 3, 1957. 27p. Contract W-31-109-Eng-52. $0.35(OTS).

Experimental results were obtained by decontaminating Na equipment used in an MTR in-pile loop irradiation test. The following procedures were devised and are recommended for any radioactive Na system. A preliminary scrubbing with alcohol at 250°C is followed by decontamination by brushing with 5 wt. % Alconox or Calgonite aqueous solution. Where it is required, a 24-hr soak in Versene is as effective as the detergent scrub. A reduction in activity by a factor of 6 or 7 is thus achieved. A more drastic treatment utilizes 1% citric acid at 25°C. Final treatment involving 1% chromic acid–5% HNO_3 solution at 175°F should be used with extreme caution. (T.R.H.)

7932 NYO-3109

Columbia Univ., New York. School of Mines.

PHYSICAL CHEMICAL PROPERTIES OF THE SYSTEMS $NaCl-ZrCl_4$, $KCl-ZrCl_4$, AND $NaCl-KCl-ZrCl_4$. Final Report. H. H. Kellogg, L. J. Howell, and R. C. Sommer. Aug. 8, 1955. 26p. Contract AT(30-1)-1135. $0.25(OTS).

Data from phase studies of the system NaCl–KCl (1:1 molar)–$ZrCl_4$, and high-temperature data for the system $NaCl-ZrCl_4$ are presented. (T.R.H.)

7933 ORNL-2323

Oak Ridge National Lab., Tenn.

ACTIVITIES IN THE $KCl-FeCl_2$ AND $LiCl-FeCl_2$ SYSTEMS. C. Beusman. May 15, 1957. 106p. Contract W-7405-eng-26. $0.55(OTS).

Phase equilibria in the $FeCl_2-KCl$ and the $FeCl_2-LiCl$ systems were studied by means of thermal analysis and vapor pressure measurements. The solid-liquid equilibria were studied by simultaneous conventional cooling curves and differential cooling curves. Petrographic and x-ray analysis helped identify two compounds in the $FeCl_2-KCl$ system: K_2FeCl_4 and $KFeCl_3$. The $FeCl_2-LiCl$ system showed no compounds, and consisted of continuous solid solution formation. By combining total vapor pressure measurements with transportation measurements, average molecular weight values were calculated for the pure salt vapors studied, as well as for vapors from binary mixtures. From these data, vapor phase association was found to exist not only in pure salt vapor, but also in the vapor mixtures studied, with the formation of "mixed dimer" vapor species. As direct confirmation, mass spectrographic evidence was obtained for a $KFeCl_2^+$ species in the vapor above an equimolar $FeCl_2-KCl$ sample, proving the existence of the $KFeCl_3$ compound or "mixed dimer" in the vapor phase. Thermodynamic activities and associated thermodynamic functions were calculated from the monomer pressures obtained in the $FeCl_2-KCl$ system. Various structural interpretations can be given to the observed partial molar entropy and enthalpy data. (auth)

7934 UCRL-3751

California. Univ., Berkeley. Radiation Lab.

THE HEAT, FREE ENERGY, AND ENTROPY OF THE FERRATE(VI) AND SELENIDE IONS (thesis). Robert H. Wood. Apr. 9, 1957. 56p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

The heat of the reaction of aqueous K_2FeO_4 with $HClO_4$ was measured at 25°C. The heat of formation, entropy, and free energy of FeO_4^{2-} was determined. Three methods for the analysis of alkaline solutions of H_2Se were developed. Details of the methods are given. (W.L.H.)

7935 Y-1156

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

THE DETERIORATION OF REDWOOD COOLING TOWER LUMBER. F. B. Waldrop, J. R. Day and H. T. Kite. Mar. 28, 1957. 38p. Contract W-7405-eng-26. $0.30(OTS).

Literature concerning the deterioration of redwood cooling tower lumber is discussed. Evidence is presented to show that at least a part of the deterioration of cooling towers in Oak Ridge plants is due to microbiological (fungal) attack. Measures for arresting both chemical and fungal attack in these towers and of preventing such attack in new towers are suggested. (auth)

7936

THE REDUCTION OF OXIDE FILMS BY ATOMIC HYDROGEN. M. R. Piggott (Imperial Coll., London). Acta Cryst. 10, 364-8(1957) May.

The reactions of atomic hydrogen with thin films of oxides of Cu, Fe, Pb and Ni were investigated, using electron diffraction to determine the crystalline state and composition of the film before and after the action of the atomic H. No reduction was observed in the case of Fe and Ni oxides, while complete reduction was observed with the Cu and Pb oxides investigated. The crystalline state of the metal after reduction was found to depend on the concentration of the atomic H, i.e. upon the speed of the reaction. (auth)

7937

THE FORMATION OF THALLIUM CHLORIDE COMPLEXES AND THEIR EXTRACTION INTO ETHER. Donald L. Horrocks and A. F. Voigt (Iowa State Coll., Ames). J. Am. Chem. Soc. 79, 2440-3(1957) May 20.

The extraction of $TlCl_3$ into isopropyl ether has been studied using tracer techniques with Tl^{204}. Appreciable extraction occurs under conditions of high acidity, and the extraction is markedly dependent upon the ionic strength of the solution. In order to study the effect of varying acidity and chloride concentration over a wide range, the study was run at rather high ionic strength. The temperature coefficient and heat of extraction were determined in the range of 20 to 30°. The empirical formula of the extracted species was found to be $HTlCl_4$ and a higher complex, H_2TlCl_5, was found not to be extractable. At low chloride concentrations and low acidity the extraction cannot be explained completely by this mechanism and it is postulated either that $TlCl_3$ extracts or that $HTlCl_4$ ionizes in ether under these conditions. (auth)

7938

METAL–WATER REACTIONS. IV. KINETICS OF THE REACTION BETWEEN CALCIUM AND WATER VAPOR. Harry J. Svec and Charles Apel (Iowa State Coll., Ames). J. Electrochem. Soc. 104, 346-9(1957) June.

Calcium metal was reacted with water vapor in the temperature range 20 to 70°C and at water vapor pressures of 18 to 93 mm Hg. The experiments indicated that the only products were $Ca(OH)_2$ and H_2 and that the reaction proceeded according to the equation $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$. A manometric study of the reaction showed that it followed the logarithmic rate law. The rate constant was observed to be linearly dependent on water vapor pressure below 70°C and to decrease with increasing temperature in the range 20 to 50°C. At 70°C the rate constant was observed to be independent of water vapor pressure. The activation energy was found to be −7.52 kcal/mole in the pressure dependent range. (auth)

7939
REACTION OF ZIRCONIUM WITH WATER VAPOR AT SUBATMOSPHERIC PRESSURES. M. W. Mallett, W. M. Albrecht, and R. E. Bennett (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 104, 349-52(1957) June.

The reaction of iodide zirconium with water vapor at 33 mm Hg pressure was investigated in the range 300 to 600°C. The rates follow a cubic law. The cubic rate constant in $(\mu g/cm^2)^3/sec$ is $k = 6.71 \times 10^3 \exp(-29{,}700/RT)$ where 29,700 ± 700 cal/mole is the activation energy. Reaction films of monoclinic ZrO_2 are N-type semiconductors. Therefore, it is concluded that the mechanism of film formation is the same as that for the Zr-O reaction. (auth)

7940
THE USE OF FLUIDIZED BEDS FOR THE CONTINUOUS DRYING AND CALCINATION OF DISSOLVED NITRATE SALTS. A. A. Jonke, E. J. Petkus, J. W. Loeding, and S. Lawroski (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 303-19(1957) May.

A new technique has been developed for converting solutions of dissolved salts to dry, granular solids by spray-injecting the solution into a heated bed of fluidized solids. The technique has been applied on a pilot scale to the dehydration and calcination of uranyl nitrate and aluminum nitrate solutions. The experimental equipment is described, and the effect of various operating variables on factors such as particle size growth, and completeness of calcination are discussed. (auth)

7941
CONTRIBUTIONS IN DEVELOPMENT OF PHYSICAL CHEMISTRY. N M. Emanuel. Vestnik Akad. Nauk S.S.S.R. 27, 69-81(1957) Mar. (In Russian)

A review is given of the achievements of Russian scientists in physical chemistry. (R.V.J.)

AEROSOLS

7942 NYO-3435
Princeton Univ., N. J.
METALLIC SMOKES. AN ELECTRON MICROSCOPE EXAMINATION OF AEROSOLS PRODUCED BY EVAPORATION OF METALS IN HELIUM. Paul H. Till and John Turkevich. Jan. 15, 1956. 75p. Contract AT(30-1)-1301. $0.45(OTS).

A study has been made of the appearance in the electron microscope and the particle size distribution of particulate matter formed by heating a metal in helium at a definite pressure and collecting the particulate matter at various distances from the source. The following metals were studied: Cu, Ag, Au, Al, As, Sb, Bi, Mn, U, Mg, Cd, and Zn. Particle size distribution studies were made. It was shown that particle growth of Mg can be influenced by the presence of Cu. Electron diffraction studies were made of single crystals of Mg. (auth)

ANALYTICAL PROCEDURES

7943 CCC-1024-TR-239
Callery Chemical Co., Penna.
DETERMINATION OF DIMETHOXYBORANE IN METHYL BORATE SOLUTIONS. A. J. Krol, L. B. Eddy, D. R. Mackey, and A. E. Weber — M. G. Haddaway, ed. May 1, 1957. 12p. Contract NOa(s)-52-1024-c.

A titrimetric method has been developed for the determination of hydrolyzable hydrogen in $HB(OMe)_2$, based on the reaction of hydridic hydrogen with I_2 in the presence of excess I_2 and a subsequent titration of unreacted I_2 with thiosulfate. The method was found to be directly applicable to $HB(OMe)_2$ in $B(OMe)_3$ solutions in the concentration range of 0 to 15 wt. % $HB(OMe)_2$. Higher concentrations of $HB(OMe)_2$ could be determined after preliminary dilution of the sample with $B(OMe)_3$. Solutions of I_2 in either toluene or 2-propanol were suitable; however 2-propanol solutions were preferred, because the back titration of excess I_2 could be carried out in a single liquid phase. Instrumental analysis based on the measurement of refractive index appeared to have a low sensitivity, ~1% $HB(OMe)_2$ being detectable. Analyses based on the dielectric-constant measurement by means of a chemical oscillometer were found to be somewhat more sensitive, approximately 0.5% $HB(OMe)_2$ being detectable. Infrared analysis of solutions is indicated as a relatively sensitive method. (auth)

7944 CF-57-2-4
Oak Ridge National Lab., Tenn.
SPECTROGRAPHIC ANALYSIS OF NORMAL HUMAN TISSUE FROM MIAMI, FLORIDA. I. H. Tipton, M. J. Cook, R. L. Steiner, J. M. Foland, K. K. McDaniel, and S. D. Fentress. Feb. 28, 1957. 61p. Contract [W-7405-eng-26]. $10.80(ph OTS); $3.90(mf OTS).

7945 IDO-14405
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
REMOTE DETERMINATION OF FLUORIDE IN ZIRCONIUM-URANIUM FUEL PROCESSING SOLUTIONS. Fred W. Dykes, Glenn L. Booman, Maxine C. Elliott, and James E. Rein. Mar. 21, 1957. 13p. Contract AT(10-1)-205. $0.15(OTS).

An analytical method and apparatus are described for the remote determination of fluoride in highly radioactive Zr-U fuel recovery samples. Fluoride is separated by pyrohydrolysis in Ni combustion apparatus. The evolved HF is then titrated with standard $Th(NO_3)_4$ to a conductometric end point. Under routine conditions, for sample aliquots containing from 0.25 to 1 milliequivalent of fluoride, the precision is ± 0.055 milliequivalents standard deviation for a single determination. (auth)

7946 IGO-AM/W-62
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE SAMPLING OF CARBON DIOXIDE UNDER PRESSURE IN REACTOR COLLING CIRCUITS, STORAGE TANK ULLAGES AND ROAD TANKER ULLAGES. Apr. 8, 1957. 4p.

A sample cylinder fitted with a valve at each end is coupled to the sampling point by means of a flexible pressure line incorporating a T-piece and valve at the cylinder end. The line and cylinder are flushed out with the sample gas and the cylinder is finally filled with gas at the pressure of the system being sampled. (auth)

7947 IGO-AM/W-63
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE DETERMINATION AND SEPARATION OF THE RESIDUAL GAS IN CARBON DIOXIDE AFTER ABSORPTION WITH POTASSIUM HYDROXIDE. Apr. 1957. 13p.

A measured volume of the gas is collected over brine and absorbed with KOH solution. The residual gas is mreasured in a calibrated portion of the absorption vessel and removed into a suitable container for analysis by the mass spectrograph. (auth)

7948 IGO-AM/W-83
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
DETERMINATION OF CARBON MONOXIDE IN CARBON DIOXIDE. Apr. 18, 1957. 6p.

A measured volume of CO_2 is thoroughly dried and then passed through a tube containing iodine pentoxide at 150°C. The liberated iodine is collected in potassium iodide solution and is determined volumetrically using standard sodium thiosulfate solution. (auth)

7949 NMI-1171
Nuclear Metals, Inc., Cambridge, Mass.
THE CHEMICAL ANALYSIS OF ZIRCONIUM AND ZIRCALOY METALS. E. B. Read and H. M. Read. Jan. 31, 1957. 110p. Contract AT(30-1)-1565. $0.60(OTS).

As a result of the cooperative effort, methods are now available for the quantitative determination of most of the impurities found in commercial Zr. Chemical and spectrographic methods are used in analysis for elements other than Hf. Spectrographic, x-ray-fluorescence, and pile-activation techniques were applied to the analysis for Hf. (auth)

7950
SPECTROPHOTOMETRIC DETERMINATION OF TUNGSTEN IN TANTALUM, TITANIUM, AND ZIRCONIUM USING DITHIOL. Paul Greenberg (Electro Metallurgical Co., Niagara Falls, N. Y.). Anal. Chem. 29, 896-8(1957) June.

Dithiol is used to determine from 0.01 to 0.2 mg of W spectrophotometrically in Ta, Ti, or Zr. After solution of sample in dilute HF, W is reduced with Ti sponge or Ti^{3+} solution. Tungsten^{5+} reacts with dithiol to form a blue-green complex which is extractable with amyl acetate. Absorbance is measured at 640 mμ. (auth)

7951
TANTALUM DETERMINATION IN PRESENCE OF NIOBIUM BY PRECIPITATION WITH N-BENZOYL-N-PHENYLHYDROXYLAMINE. Ross W. Moshier and James E. Schwarberg (Wright-Patterson Air Force Base, Ohio). Anal. Chem. 29, 947-51(1957) June.

Tantalum is separated quantitatively from Nb, Ti, and Zr by two to three precipitations with N-benzoyl-N-phenylhydroxylamine from HF–H_2SO_4 solution at pH 1.0. Operating time is much less than that of other methods and precipitate, which is ignited to oxide, is uncontaminated by other metals. (auth)

7952
VOLUMETRIC DETERMINATION OF URANIUM. TITANOUS SULFATE AS REDUCTANT BEFORE OXIDIMETRIC TITRATION. James S. Wahlberg, Dwight L. Skinner, and Lewis F. Rader, Jr. (U. S. Geological Survey, Denver, Colo.). Anal. Chem. 29, 954-7(1957) June.

Titanous sulfate is used as a reductant in a rapid, accurate method for routine determination of U in U-rich materials. Removal of hydrogen sulfide group is not necessary and metals precipitated by cupferron are removed by filtration. Cupric ion serves as indicator for excess of $Ti_2(SO_4)_3$. Titration is made with standard ceric sulfate solution. (auth)

7953
THORON–MESO-TARTARIC ACID SYSTEM FOR DETERMINATION OF THORIUM. Mary H. Fletcher, F. S. Grimaldi, and Lillie B. Jenkins (U. S. Geological Survey, Washington). Anal. Chem. 29, 963-7(1957) June.

In the spectrophotometric determination of Th in mineral separates with thoron, meso-tartaric acid is an effective masking agent for Zr, 400 mg. masking as much as 5 mg. of ZrO_2. Standard curve of absorbance vs. Th is linear from 2 to 150 γ of ThO_2 per 25 ml. of solution. (auth)

7954
ION-EXCHANGE METHODS FOR THE QUANTITATIVE SEPARATION OF THE ALKALINE EARTHS, AND THEIR APPLICATION TO THE DETERMINATION OF Sr^{90} IN MILK ASH. Gwen M. Milton and W. E. Grummitt (Atomic Energy of Canada Ltd., Chalk River, Ontario). Can. J. Chem. 35, 541-51(1957) June.

A study has been made of the effects of column loading and eluting agent on the cation-exchange separation of the alkaline earths — Be, Mg, Ca, Sr, Ba, and Ra. The principal eluting agents tested were ammonium lactate, ammonium citrate, and HCl. Dowex-50 resin (Ion X, 300–400 mesh) was used throughout the investigation, and the column temperature was maintained at approximately 80°C. Under optimum conditions, involving the use of 0.25 g. of resin per milliequivalent of sample and with ammonium lactate eluant (0.55 M at pH 5 for Be, and 1.5 M at pH 7 for Mg, Ca, Sr, Ba, and Ra), a quantitative separation of all six elements in a single sample is possible in 5 hours. This procedure has been applied to the routine analysis of Sr^{90} in bulk milk ash samples, containing 20 mg. of Sr carrier, with yields of 85 to 95%. By the same method trace amounts of Sr naturally occurring in milk have also been determined. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

7955
CRYSTALLOGRAPHIC DATA: ALUMINUM TRIFLUORIDE, AlF_3. Eugene Staritzky and L. B. Asprey (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 984(1957) June. MOLYBDENUM METAPHOSPHATE, $Mo(PO_3)_3$. R. M. Douglass and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 985(1957) June.

FLUORINE AND FLUORINE COMPOUNDS

7956 TID-3507
Technical Information Service Extension, AEC.
U. S. ATOMIC ENERGY COMMISSION REPORTS ON ELEMENTAL FLUORINE. Sidney F. Lanier, comp. May 1957. 13p. $0.15(OTS).

An annotated bibliography is presented which contains 42 references on generation, cell design, handling, analysis, toxicity, and other topics of interest in the commercial production of F_2. (T.R.H.)

Refer also to abstract 7907.

GRAPHITE

7957 AECD-3758
Great Lakes Carbon Corp., Morton Grove, Ill.
MODIFICATIONS OF THE F PROCESS. Final Report. L. H. Juel. [1952]. Decl. June 12, 1956. 58p. Contract AT(11-1)-172. $0.40(OTS).

Research for improvement and simplification of the F process for the purification of graphite is described. It is concluded that graphite can be purified on a pilot plant scale using CF_4, SF_6, or Cl_2. Graphite purified by these materials is equal to or better than F process graphite. Repeated application of the F process does not increase graphite purity. An ash analysis of purified graphite revealed the presence of Ca, Fe, Mg, Na, K, Cs, Al, Si, Zn, and Li. The upper limit of ash contribution to the neutron absorption cross-section of the graphite is about 0.08 mb. A calcined petroleum carbon containing up to 2% combined Cl was produced, but graphite from this "chlorocoke" was not suitable for reactor use. The production of reactor grade graphite from purified raw materials appears to be feasible but not competitive with the F process. (T.R.H.)

7958 CRC-693
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
EXPERIMENTAL DETERMINATION OF STORED ENERGY IN GRAPHITE IRRADIATED WITH NEUTRONS. R. W. Attree, R. L. Cushing, and J. Pieroni. Mar. 1957. 27p. (AECL-442).

In samples irradiated below 100°C, considerable recovery takes place when the sample is annealed to 500°C, accompanied by release of heat energy. Results are given on the measurement of the rate of release of this stored

energy as a function of temperature for various irradiation times and for two types of graphite, a dense compacted natural graphite, and an artificial petroleum cake graphite. (M.H.R.)

7959

ENERGY OF ADSORPTION FORCES AND HEAT OF ADSORPTION OF SIMPLE MOLECULES ON GRAPHITE. N. N. Avgul and A. V. Kiselev (Inst. of Physical Chemistry, Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk, 230-2(1957) Feb. (In Russian)

Calculations were made of the adsorption energy of isolated atoms and A, K, N, and NH_3 molecules on graphite based on their electrical, magnetic, and geometric properties. Results of theoretical calculations are in good agreement with the experimental calorimetric data. (R.V.J.)

LABORATORIES AND EQUIPMENT

7960 HW-49211

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SIMPLIFIED PANELING FOR CONTAMINATION BARRIERS. H. A. Moulthrop. Apr. 10, 1957. 25p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

An intensive review of fundamental needs which should be satisfied by a contamination barrier resulted in the selection of the metal T-section as the basic structural member in the proposed method of barrier paneling. The T-section shape satisfies the requirements of simplified construction, structural strength, easy maintenance, operability, and effectiveness as a barrier to contaminants. Its use for the framing of barrier panels offers several advantages over conventional panel hood construction. (auth)

RADIATION EFFECTS

7961 LP-146(Del.)

[Massachusetts Inst. of Tech., Cambridge]. Lexington Project.

EFFECTS OF NUCLEAR RADIATIONS ON LUBRICANTS AND GASOLINE. Clark Goodman. Sept. 7, 1948. Decl. with deletions Mar. 12, 1957. 5p. $1.80(ph OTS); $1.80 (mf OTS).

Ordinary lubricants and chemical fuels have a tolerance of about 10^7 r while selected lubricants have a tolerance of about 10^8 r. (W.L.H.)

7962

EFFECTS OF STRUCTURE, PRODUCT CONCENTRATION, OXYGEN, TEMPERATURE AND PHASE ON THE RADIOLYSIS OF ALKYL IODIDES. Evalyn O. Hornig and John E. Willard (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 79, 2429-34(1957) May 20.

7963

QUANTITATIVE TREATMENT OF THE ELEMENTARY PROCESSES IN THE RADIOLYSIS OF ALKYL IODIDES BY γ-RAYS. Robert J. Hanrahan and John E. Willard (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 79, 2434-40 (1957) May 20.

RARE EARTHS AND RARE-EARTH COMPOUNDS

7964 KAPL-M-GLP-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THERMAL EXPANSION OF FOUR RARE EARTH OXIDES. G. L. Ploetz, C. W. Krystyniak, and H. E. Dumes. Mar. 28, 1957. 7p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The coefficients of linear thermal expansion for 95% dense samples for 4 rare earth oxides were determined using an interferometer. The values reported are: Sm_2O_3, 10.8×10^{-6} cm/cm/°C from 30 to 740°C; Eu_2O_3; 10.5×10^{-6} cm/cm/°C from 30 to 840°C; Gd_2O_3, 10.0×10^{-6} cm/cm/°C from 30 to 840°C; and Dy_2O_3, 8.3×10^{-6} cm/cm/°C. (T.R.H.)

SEPARATION PROCEDURES

7965 HW-32466

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RELATION OF SEPARATIONS PLANT EQUIPMENT EXPERIENCE TO THE PUREX DESIGN. Separations P. E. Report No. 48. F. A. Hollenbach. June 23, 1954. Changed from OFFICIAL USE ONLY May 22, 1957. 10p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The life experience of the various types of equipment currently in separations plant service (Redox, TBP, and $BiPO_4$) is recorded. Special features in the Purex plant equipment which resulted from consideration of the observed weaknesses are described. The sparing philosophy used for the various equipment groups in the Purex plant is also given. (T.R.H.)

7966 HW-36836

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PUREX PULSE GENERATOR OPERATION. P. B. McCarthy. May 11, 1955. Changed from OFFICIAL USE ONLY May 16, 1957. 11p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A large (Size 2) Purex pulse generator was installed in the 321 Building Tank Farm to pulse solutions in the prototype Purex HA Column. Flow sheet considerations indicated a need for information on leakage rates with various size weep holes in the pulse generator piston. In addition to leakage tests, experiments were conducted to determine the air required under the piston to hold the column contents away from the pulse generator piston thereby preventing leakage during shut down and to determine the time required to bleed the air trapped in the pulse leg when the column is first filled. (auth)

7967 HW-47676

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

REMOVAL OF IODINE-131 FROM DISSOLVER OFF-GAS STREAMS BY ISOTOPIC EXCHANGE. E. D. McClanahan, Jr. Nov. 15, 1956. 19p. Contract W-31-109-Eng-52. $0.20(OTS).

Experiments were performed which indicate that iodine atoms in plant off-gas streams exchange with those in solid AgI in the temperature range 250 to 350°C. The exchange is fast enough to make it of practical use for removing I^{131} at concentrations as low as 10^{-7} gm/ft^3. An AgI reactor would best be employed as a back-up facility for an $AgNO_3$ reactor. The combined efficiency of the two could give decontamination factors in excess of 10^4. (auth)

7968 KAPL-1518

Knolls Atomic Power Lab., Schenectady, N. Y.

URANIUM METAL PREPARATION BY ELECTROLYTIC REDUCTION OF OXIDES. L. W. Niedrach and B. E. Dearing. Mar. 12, 1956. Changed from OFFICIAL USE ONLY Dec. 31, 1956. 37p. Contract W-31-109-Eng-52. $0.40(OTS).

A continuous process is outlined for the production of U metal by electrolytic reduction of uranium oxides. The same process is recommended for recovering scrap U from high temperature processing operations on reactor fuel. Laboratory work that has been done towards developing such a process is briefly reviewed. The advantages of

such a process are outlined, and the areas requiring additional development work are indicated. Additional development work on the process is recommended. (auth)

7969 ORNL-2297
Oak Ridge National Lab., Tenn.
REMOVAL OF FISSION PRODUCTS FROM REACTOR WASTES: LABORATORY STUDIES OF LIQUID-LIQUID EXTRACTION FROM AN ACID ALUMINUM NITRATE SOLUTION. Herman L. Krieger, Bernd Kahn, and Conrad P. Straub. May 24, 1957. 36p. Contract W-7405-eng-26. $0.30(OTS).

Liquid-liquid extraction of the major long-lived fission products was evaluated as a method for decontaminating an acid aluminum nitrate waste. Tributyl phosphate, di-2-ethylhexyl phosphoric acid, tridecyl phosphine oxide, tri-n-octyl amine and thenoyl trifluoroacetone were found to be effective in extracting one or more of the Ce, Y, Zr, Nb, and Ru tracers used in this study. After converting Ru and Nb to an extractable form, more than 99% of the tracers was extracted into undiluted tributyl phosphate. Cesium was not extracted, and Sr very slightly extracted. The extracted radionuclides were stripped from tributyl phosphate with water, dilute hydrofluoric acid and nitric acid, permitting reuse of the organic phase. (auth)

7970 RMO-2652
Allied Chemical and Dye Corp. General Chemical Div., New York.
[REPORT FOR MARCH 1954]. PART A. LEACHED ZONE ORES—FILTRATION STUDIES. PART B. URANIUM EXTRACTION FROM GENERAL'S PHOSPHORIC ACID—USE OF ESTERS OF HIGHER ALCOHOLS. A. W. Yodis, R. T. Holzmann, and J. L. Burhans. Mar. 30, 1954. Decl. Nov. 22, 1955. 4p. Contract AT(49-6)-913. (GEN-3). $1.80(ph OTS); $1.80(mf OTS).

7971 RMO-2805
Colorado School of Mines Research Foundation, [Inc.], Golden.
RECOVERY OF URANIUM VALUES FROM ORE AND CONCENTRATE SAMPLES. COLORADO PRIMARY ORES. Progress Report No. 5. June 30, 1955. 71p. CSMRF Project No. 530208. Contract AT(49-6)-916. $0.45(OTS).

The objective of the phase of the project was to apply ore-dressing techniques on the four uraninite ores from Gilpin and Jefferson Co. in Colo., with special emphasis on the flotation technique developed for the Beaverlodge ore. No fixed objective was set on concentrate grade and recovery of U_3O_8. The scope of the investigation was limited to ore-dressing methods. Chemical approaches, involving solution and precipitation of U salts, were considered beyond the scope of this investigation. (auth)

7972 AEC-tr-2879
A MULTIPILICATIVE PROCEDURE FOR THE SEPARATION OF GAS MIXTURES, ESPECIALLY BY THE USE OF GRAVITATIONAL FIELDS. Hans Martin and Werner Kuhn. Translated from Z. phys. Chem. 189A, 219-316 (1941). 93p.

A multiplicative procedure is described that makes it generally possible in principle to secure arbitrarily large multiplication of weak separation effects (single effects) occurring in gas mixtures (isotopic mixtures), for example those produced by the action of a gravitational field or a temperature gradient, and thus to perfect to an arbitrary degree the separation that is only partial in the single effect. An essential feature of the procedure is that the mixture circulates in a definite way inside the space in which it is contained. (auth)

7973
MAGNESIUM EXTRACTION PROCESS FOR PLUTONIUM SEPARATION FROM URANIUM. Irvin O. Winsch and Leslie Burris, Jr. (Argonne National Lab., Lemont, Ill.). Chem. Eng. Progr. 53, 237-42(1957) May.

A high-temperature extraction process for the separation of plutonium from nuclear reactor core and blanket materials is described and data are presented. Molten Mg, which is immiscible with molten U, may be used to extract Pu from U. Plutonium distributes between Mg and U or the lower melting U alloys such as U–Cr and U–Fe with a distribution coefficient of about 2 (weight basis) in favor of the Mg. The Pu may be separated from the Mg by volatilization of the Mg. Auxiliary operations such as molten-metal transfer, phase separation, and sampling are also discussed. (auth)

7974
A RAPID, QUANTITATIVE SEPARATION OF TRACES OF BERYLLIUM. Jack Schubert, Arthur Lindenbaum, and William Westfall (Argonne National Lab., Lemont, Ill.). Chimia (Switz.) 11, 50-1(1957).

A method for separation of micro amounts of Be from bone and rock, and from interfering ions such as Cu^{++} is given. The Be is selectively eluted from Dowex-50 cation exchange resin with > 0.02 M sulfosalicylic or gentisic acid, at a pH of 3 to 4.5. (T.R.H.)

7975
THE INTER-DIFFUSION OF TWO CHARGED PARTICLES (WITH PARTICULAR REFERENCE TO ION-EXCHANGE IN ZEOLITES). I. R. Beattie (King's Coll., London) and D. R. Davis (The Univ., Sheffield). Phil. Mag. (8) 2, 599-606(1957) May.

The general importance of ion exchange is mentioned, together with the work of previous investigators. The mechanism whereby two ions may change places is examined, and it is concluded that in many cases two ions diffusing in opposite directions in a charged substrate will diffuse independently of one another apart from any space charge effects. An equation is developed relating the amount of material exchanged during a reaction with the square root of the duration of the experiment. Practical applications of this equation are briefly discussed, as is the effect of immiscibility of solid solutions within the exchanger. (auth)

SORPTION PHENOMENA

7976 OSR-TN-57-151
Cornell Univ., Ithaca, N. Y.
THE ADSORPTION OF NICKEL AND ZIRCONIUM ON A CLEAN MOLYBDENUM SURFACE IN THE FIELD EMISSION MICROSCOPE. Technical Report No. 5 [on] THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE ATOMIC PHENOMENA OCCURRING ON AND NEAR THE SURFACES OF SOLIDS. E. O. McIrvine and R. C. Bradley. May 1, 1957. 64p. Contract AF18(600)-674. (AD-126440).

SYNTHESES

7977 BNL-3084
Brookhaven National Lab., Upton, N. Y.
THE CHEMICAL CONSEQUENCES OF THE $N^{14}(n,p)C^{14}$ REACTION IN THE ACETAMIDE SYSTEM AND THE IMPLICATIONS OF NUCLEAR RECOIL AS A TOOL FOR SYNTHESIS. Alfred P. Wolf, Carol S. Redvanly, and R. Christian Anderson. [1956]. 34p. $6.30(ph OTS); $3.00(mf OTS).

Acetic acid-1,2-C_1^{14} and propionic acid-1,2,3-C_1^{14} have been prepared from acetamide irradiated in a nuclear reactor. The distribution of activity in acetic acid averages 62% in the carbonyl carbon and 38% in the methyl carbon. For propionic acid obtained by basic hydrolysis of the

amide we found 24% in the carbonyl carbon, 24% in methylene carbon and 52% in the methyl carbon. These results are interpreted in terms of chemical mechanisms being the determining factors in the labeling process. The formation of acetone-1,2-C_1^{14} with 80% of the activity in the methyl groups and 20% of the activity in the carbonyl group is also reported. Acetonitrile as a product of the radiation chemistry of the system is mentioned. The implication of this work with regard to using nuclear recoil as a tool for the synthesis of labeled compounds is discussed. (auth)

7978 HARD(B)/P-4

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION OF DEUTERIUM SULPHATE. D. E. Glanville. Feb. 23, 1956. 5p.

The preparation of ~250 ml of 6N D_2SO_4 by dissolution of SO_3 in D_2O, and the apparatus used are described. (T.R.H.)

ENGINEERING

7979

VESSELS FOR THE STORAGE AND TRANSPORT OF LIQUID HYDROGEN. B. W. Birmingham, E. H. Brown, C. R. Class, and A. F. Schmidt. J. Research Natl. Bur. Standards 58, 243-53(1957) May.

The design and construction of a large-scale hydrogen liquefier by the National Bureau of Standards required a concurrent development of large, transportable liquid-hydrogen containers. These containers, known as Dewar vessels after the inventor, James Dewar, had to be capable of road and air transport, which implied ruggedness and light weight. This article reports on large-scale liquid-hydrogen Dewar development conducted by the NBS Cryogenic Engineering Laboratory. A 440-liter and an 840-liter Dewar are discussed. Every effort has been made to design Dewars with very low hydrogen-loss rates within the limitations of the transport requirement. (auth)

7980

THERMAL DESIGN OF LARGE STORAGE VESSELS FOR LIQUID HYDROGEN AND HELIUM. Russell B. Scott. J. Research Natl. Bur. Standards 58, 317-25(1957) June.

Principles of insulating vessels for the storage and transportation of liquefied gases are discussed. The use of shields cooled by the vapor leaving the liquid being stored is analyzed, and formulas, graphs, and tables are presented for the convenience of the designer of large vessels for storing and transporting liquid hydrogen and liquid helium. An analysis is given of the use of escaping vapor to intercept heat entering by conduction through solid supporting members. The evidence presented indicates that substantial improvements are possible in the design of such vessels. (auth)

MATERIALS TESTING

7981 WADC-TR-53-466(Pt. II)

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF DRY FILM LUBRICANTS. Period covered: June 1954 to June 1955. Bernard Rubin. Sept. 1956. 26p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANT MECHANICAL EVALUATION. (AD-97318).

A large number of commercial films were evaluated by the previously reported Falex Test procedure and wide variation in wear endurance life noted. The nature of failure pattern and effect of load are noted for some of these films. Certain films showed very good life in the repeatable 30-minute test procedure. Titanium disulfide in a resin binder had poor friction and endurance properties. Tung-Lube, a proprietary friction reducer, showed some promise and should be evaluated further. Preliminary data at elevated temperatures indicate that high temperature static soak (to 500°F) and subsequent test at room ambient temperature is much less severe on endurance life than evaluation at 225°F. Endurance life of films on line contact specimens (block and cylinder) is shown to vary inversely with speed and load. However, at light loads sliding velocities of 300 to 400 feet per minute for significantly useful periods of time under unidirectional motion have been observed for a representative dry friction reducing film. (auth)

PUMPS

7982

CONSIDERATIONS FOR SELECTION OF LIQUID METAL PUMPS. F. G. Hammitt (Univ. of Michigan, Ann Arbor). Chem. Eng. Progr. 53, 249-53(1957) May.

The design and development of large-scale, liquid-metal circulating pumps such as would be suited to application in nuclear power plants have been investigated. Fluid dynamic problems—cavitation and erosion damage to the structural components at the high relative velocities obtained in the pump impeller—were the particular concern. (auth)

WASTE DISPOSAL

7983 HW-24500

Hanford Works, Richland, Wash.

PROTECTION OF EXTERIOR BURIED WASTE LINES. Engineering Study No. 6. G. U. Udine. Sept. 24, 1952. Changed from OFFICIAL USE ONLY May 22, 1957. 43p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30(mf OTS).

The protection of buried waste lines from radiochemical plants at Hanford is discussed. Methods in general use and methods presently used at Hanford are evaluated. Proposed types of waste line encasements, cathodic protection, and hazards from possible leaks in existing lines are discussed. A comparison of costs of existing and proposed methods is made and recommendations are given. (T.R.H.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

7984 AECU-3482

[Carborundum Metals Co., Inc., Akron, N. Y.]

PRODUCTION OF ZIRCONIUM OXIDE CARBON BRIQUETTES. Richard F. Klee. Aug. 23, 1955. 6p. Contract [AT(11-1)-404]. (CMC-U-55-3). $1.80(ph OTS); $1.80(mf OTS).

A procedure for the production of dry, hard, and compact ZrO_2–C briquettes by calcining is described. (W.L.H.)

7985 NP-6312

Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.

TABLES OF DIELECTRIC MATERIALS. VOLUME V.

Technical Report No. 119. Apr. 1957. 279p. Contract Nonr-1841(10).

Tabulated dielectric data at room temperature and at fixed frequencies as functions of temperature are given for several inorganic and organic solids, liquids, and gases. Low field strength data at fixed temperatures as functions of frequency, and hysteresis loops and saturation magnetization data for a series of ferromagnetic dielectrics are presented. Attenuator characteristics (attenuation, phase shifts, and intrinsic impedance) of ferrites, conducting ceramics, conducting plastics, carbon–plastic mixtures and magnetic plastic mixtures are included in graphic forms. (R.V.J.)

7986

ELECTROLYSIS OF $CaO-Al_2O_3-SiO_2$ MELTS. O. A. Esin and V. A. Chechulin. (Kirov Ural Polytechnic Inst.). Doklady Akad. Nauk S.S.S.R. 113, 109-11(1957) Mar. 1. (In Russian)

Tables for $CaO-Al_2O_3-SiO_2$ melt electrolysis (for cathode cells h/d = 7.5 to 8.0) in the temperature interval from 1385 to 1440°C revealed Si as the basic cathode product with the yield varying with the current from 38 to 71% and the Al yield about 24%. The total power utilization was from 42 to 90%. Analysis was made to determine the processes which consume the balance of the electrical power. Data on anode dissolving of Si from Fe–Si (21.3% Si) and Cu–Si(17.5% Si) in various slags are also included. (R.V.J.)

7987

ON WAYS OF CONTROLLING THE MICROSTRUCTURE OF CORUNDUM CERAMICS. G. N Volosevich and D. N. Poluboyarinov. Doklady Akad. Nauk S.S.S.R. 113, 152-5 (1957) Mar. 1. (In Russian)

Specimens of corundum ceramics were prepared by adding clay annealed at 1450°. After crushing and cleaning the content of the clay was: 99.89% Al_2O_3; 0.04% SiO_2; 0.02% Fe_2O_3; and 0.05% Na_2O_2. The dispersion was 1 μ, grain size maximum up to ~2μ, specific gravity 3.97, and refractive index 1.750. The crystallization structure, crystal size, and porosity were studied in reflectory light. At high temperatures of annealing, the crystal grains grew very intensely; at 1650° the crystal growth slowed down. Fine-crystal ceramics were prepared by rapid heat treatment, however, with a prolonged or repeated treatment, the ceramic body re-acquired the large crystal structure (3 hr at 1700°, the crystal size grew up to 200 × 80 μ.). At 1850° the mean size of the corundum crystal was 1 to 1.5 μ. Admixtures of 0.5 to 2.5% of MgO caused a sharp decrease of crystal grains which was followed by alterations in crystal shape. Effects of other admixtures were analyzed. (R.V.J.)

7988

THE VISCOSITY OF $MnO-SiO_2-Al_2O_3$ SLAG MELTS. S. M. Mikiashivili, A. M. Samarin, and L. M. Tsylev. Izvest Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 1, 115-22(1957) Jan. (In Russian)

The viscosity and flowability of the $MnO-SiO_2-Al_2O_3$ system of the lowest melting point were studied. Specimens of prepared slags of 20 to 75% MnO, 10 to 55% SiO_2, and 5 to 30% Al_2O_3 with 5% range of each components were measured with a rotation electroviscosimeter. Diagrams of viscosity were constructed for temperatures of 1400, 1500, and 1590°. The viscosity of homogeneous flowability increased with the increase of silicate and could be basically determined by the size of the silicate oxide anions. However, the viscosity of heterogeneous flowability melts at temperatures of 1400° to 1590° increased with the reduction of the amount of silicate and was determined by the quantity of solid phase. The lowest viscosities were observed in melts with $MnO : Al_2O_3 = 6$ and from 20 to 35% silicate. With a reduced ratio of $MnO : Al_2O_3$, the viscosity of melts increases. An increase of MnO decreases the viscosity of homogeneous fluid melts. (R.V.J.)

7989

EFFECTS OF THERMAL TREATMENT ON THE MECHANICAL STRENGTH OF CERAMICS. N. P. Bogoroditskii, G. V. Bois, et al. Zhur. Tekh. Fiz. 27, 675-81(1957) Apr. (In Russian)

Tests were made with three types of ceramic materials: corundum-base ultraporcelain with ~30% vitreous phase and corundum crystal over 4μ; rutile-base ceramics with crystal size varying from 2 to 40μ after roasting and small vitreous phase about 5%; and, zirconium titanate ceramics with vitreous phase of intermediate position between the above materials and crystals of 10 to 15μ. A strong bond was found between mechanical strength and the boundary layer forming between the crystals which results in additional crystallization and microfracturing. The mechanical and electrical strength of ceramics are closely related, and electrical strength drops on one unit due to microfracturing. Annealing at temperatures above the critical temperature improves the mechanical strength of the ceramics. (R.V.J.)

CORROSION

7990 CF-57-5-107

Oak Ridge National Lab., Tenn.

LOW ATTACK RATES OBSERVED IN TOROID TESTS WITH 28 MICRON 1600°C FIRED ThO_2 SPHERES. D. G. Thomas. May 28, 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Results of previous toroid tests with 28 μ, 1600° fired ThO_2 spheres are analyzed. Four possible explanations for the essentially zero attack rates are offered and discussed: peculiar motion of toroids or some unknown wall effect; rotational hydrodynamic forces cushioning the particle impact; the bed was not in suspension and not sliding over the walls of the toroid; round particles are not as erosive to oxide film surfaces as sharp pointed particles. (T.R.H.)

7991 HW-49631

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TECHNIQUE OF ALUMINUM CORROSION MEASUREMENT. A. Russell. Mar. 4, 1957. 10p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Methods of measuring the corrosion product formed on Al and various Al alloys are discussed. The Al was in the form of wafers or coupons measuring approximately 1 × 1 × 0.1 in. The coupons were exposed to high temperature water (above 200°C) in the presence of injected H_3PO_4 for various time intervals. X-ray defraction analysis of the corrosion product has shown it to have the formula $2\,Al_2PO_4(OH)_3$ or $(Al_2O_3)_2.P_2O_5.3H_2O$. There are several general methods of measuring the amount of corrosion product included. (auth)

7992

CORROSION OF STAINLESS STEELS IN SUPERCRITICAL WATER. Walter K. Boyd and H. A. Pray (Battelle Memorial Inst., Columbus, Ohio). Corrosion 13, 375t-85t (1957) June.

The behavior of stainless steels, including both hardenable and nonhardenable grades, in degassed supercritical water at 800, 1000, and 1350 F and a pressure of 5000 psi is described. In general, the corrosion at 1350 F observed for the alloys was found to be intergranular, while at 1000 F, only Inconel X exhibited selective penetration along grain boundaries. All alloys suffered some decarburization and carbide precipitation after exposure to supercritical water at 1350 F. No significant phase changes were observed at 800 and 1000 F. The

Armco 17-4PH, Armco 17-7PH, and Hastelloy F alloys were the most resistant materials at 1350 and 1000 F. All of the alloys evaluated had excellent resistance to 800 F degassed supercritical water. The AISI Type 316 material was shown to be susceptible to stress-corrosion cracking at 1350 F. (auth)

7993

SOME UNUSUAL EFFECTS OF HYDROGEN IN CORROSION REACTIONS. J. E. Draley and W. E. Ruther (Argonne National Lab., Lemont, Ill.). J. Electrochem. Soc. 104, 329-33(1957) June.

Consideration of corrosion in the presence of water has led to the postulation of damage by hydrogen produced in the reaction. For cases where the metal surface is covered with a protective layer, it is considered that some hydrogen ions diffuse through the layer and form hydrogen atoms beneath it. The consequence of the production of hydrogen in this location is to decrease corrosion resistance. Three types of harmful effects are illustrated. (auth)

7994

KINETICS OF THE OXIDATION OF CHROMIUM. Earl A. Gulbransen and Kenneth F. Andrew (Westinghouse Electric Corp., Pittsburgh). J. Electrochem. Soc. 104, 334-8(1957) June.

The oxidation of high purity Cr was studied over the temperature range 700 to 1100°C using the vacuum microbalance method. Below 900°C conventional oxidation curves were obtained which can be fitted to the parabolic rate law. Above 900°C and for a film thickness of approximately 4800A, the rate of oxidation increased in an unusual manner. This increase in the rate of oxidation disappeared on further oxidation. At temperatures of 1050°C and higher a large increase occurred in the rate of oxidation, suggesting that the oxide film was no longer protective for film thicknesses greater than 42,000A. A logarithmic plot of the parabolic rate law constant vs. 1/T shows two straight lines separated by a transformation region. This gives 37,500 cal/mole and −15.3 entropy units for heat of activation and entropy of activation between 700 and 900°C and 59,400 cal/mole and +6.2 entropy units for 1000 to 1100°C. The rate of evaporation and the rate of oxidation of Cr are equal at about 950°C. This corresponds to the transformation region between the two mechanisms of oxidation. It is concluded that the failure of Cr in oxidation is closely related to the high vapor pressure of Cr above 900°C. (auth)

7995

PLANSEE PROCEEDINGS, 1955. SINTERED HIGH-TEMPERATURE AND CORROSION-RESISTANT MATERIALS. F. Benesovsky, ed. London, Pergamon Press Ltd., 1956. 480p.

Articles are presented in English, German, and French on the problems of corrosion resistance of sintered materials used in the chemical industry and in construction of nuclear reactors. The theoretical problems of surface oxidation processes, the formation of oxide compounds in solid states, radioactive diffusion and transition processes at high temperatures were studied. The powder metallurgy in preparing the refractory metals and their alloys, the cemented carbides and borides, and oxide-metal combinations are discussed. The properties of the most promising hard materials (refractory carbides, borides, and silicides) and special products prepared on the basis of these materials are evaluated. The refractory transition metals and their alloys, and the combinations of metallic and nonmetallic components are analyzed. (R.V.J.)

GEOLOGY AND MINERALOGY

7996

EASTERN AND CENTRAL MONTANA AS A POSSIBLE SOURCE AREA OF URANIUM. Frank C. Armstrong (U. S. Geological Survey, Spokane, Wash.). Econ. Geol. 52, 211-24(1957) May.

Geologic settings in central and eastern Montana and in a few places in southwestern Montana are similar to the settings in areas favorable for the occurrence of uranium deposits. Several areas in Montana seem especially favorable for the occurrence of uranium. The alkalic igneous rock province of central Montana is similar to the one of the Colorado Plateau. On the basis of this analogy, certain areas in Montana, where the lithology and (or) structure are considered favorable for the occurrence of uranium, are suggested for prospecting. Seleniferous plants, similar to those that are uranium indicators on the Colorado Plateau, might be used as an aid in prospecting for uranium provided that the seleniferous shale areas are taken into account. Uranium deposits, similar to those in North and South Dakota, may be found in Cretaceous and Tertiary sandstones, lignites, and low-grade coals of eastern Montana; also, the magnetite-bearing beds of certain Cretaceous sandstones may contain fossil placer deposits of radioactive black minerals. The occurrence of uranium in basal conglomerates, quartzites, and sandstones in Africa and Ontario suggests that similar basal sedimentary rocks in central Montana may contain uranium. Many of the radioactivity anomalies in Montana found from the air are closely associated with the Eagle sandstone; others are associated with Precambrian basement rocks, Upper Cretaceous and Lower Tertiary igneous rocks, or sedimentary rocks of Jurassic and Cretaceous age. Glacial cover and lack of outcrops locally may hinder prospecting for uranium. (auth)

7997

SULFUR ISOTOPES AND MINERAL PARAGENESIS. M. L. Jensen (Yale Univ., New Haven, Conn.). Econ. Geol. 52, 269-81(1957) May.

Almost all of the previous investigations of S^{32}/S^{34} ratios of sulfide minerals and ores have indicated a lack of significant variations in the ratios of specimens collected from one deposit. Most of these valuable previous studies have been done by non-geologists upon, unfortunately, limited and poorly representative mineral suites of sulfide deposits with little regard for the geologic occurrence and paragenesis of the sulfides present in the given deposit. This study of S^{32}/S^{34} ratios obtained from two or more sulfides occurring in one hand specimen indicates that appreciable variations, greater than four percent in one example, are evident. Therefore, a partial attempt is made to analyze the significance of variations in S^{32}/S^{34} ratios by means of a more detailed study of the genesis and the paragenetic relationships of the various sulfides present in selected specimens. The isotopic and geologic study of the selected specimens suggests the following: (1) a suggestion for distinguishing between exsolution and replacement is offered by isotopic ratios, (2) the mechanism of replacement of one sulfide by another is not always a diffusion mechanism of the small metal cations but also includes an exchange of the large sulfur anions, (3) hypogene ore fluids, giving rise to a vein, may vary in isotopic composition as indicated by an isotopic study of the minerals formed, and (4) the isotopic reactions that take place during supergene enrichment suggest that supergene and hypogene minerals can be distinguished by isotopic analyses. Other suggestions and avenues of investigation are also discussed. (auth)

7998

ADDITIONAL REGULARITIES AMONG DISCORDANT LEAD–URANIUM AGES. R. D. Russell (Univ. of Toronto) and L. H. Ahrens (Oxford Univ.). Geochim. et Cosmochim. Acta 11, No. 4, 213-18(1957).

The ratios N_{206}/N_{238} and N_{207}/N_{235} are linearly related in twelve samples of pitchblende from the west ore body of the Ace Mine, Goldfields, Saskatchewan. A similar relationship has been noted before in monazites and uraninites mainly from southern Africa. Wetherill has shown that such linearity could be explained by a chemical removal of lead from the mineral at some single time subsequent to its formation. It is pointed out that such an explanation leads to an apparent relationship between the time of chemical removal of lead and the age of the mineral. There appears to be a preferential deficiency (9%) of Pb^{207} over Pb^{206} in specimens participating in the linear relationships. This suggests physical control of lead escape rather than chemical. One possible process involves recoil of atoms following alpha-particle emission. Whatever the correct explanation, a convergent age of 1800 m.y. for the west ore body of the Ace Mine was found. (auth)

7999

THE IONIUM METHOD OF AGE DETERMINATION. Herbert L. Volchok and J. Laurance Kulp (Columbia Univ., Palisades, N. Y.). Geochim. et Cosmochim. Acta 11, No. 4, 219-46(1957).

The ionium method of age determination, potentially applicable to deep sea sediments over the past 400,000 years, has been studied in an attempt to define its validity and limitations. In order for the method to apply, a chronologically undisturbed sediment column must be present and the sediment must be homogeneous with regard to chemisorption potential. The experimental techniques which were employed on a number of deep-ocean cores from the Atlantic and Pacific Oceans and the Caribbean Sea included total radium and gas-phase radon measurement with a low-level ionization chamber, total alpha emission by scintillation counting and absolute surface area determination by gas adsorption. A complete age analysis was carried out on two cases: one, a red-clay core from the Pacific and the other, a globigerina-ooze core from the Caribbean. This analysis shows the sources of error. For those cores that meet the geological requirements, the accuracy of the dates is largely dependent on the accuracy of the radium determination and the frequency with which the samples are taken along the core. From these two cores rates of sedimentation can be calculated with fair precision. From 200,000 to 300,000 years ago until 30,000 to 40,000 the rates of sedimentation were apparently constant for the red clay at one locality at 0.15 ± 0.05 cm/1000 years and for the globigerina ooze at another locality at 0.60 ± 0.20 cm/1000 years. At the close of the Wisconsin the rates of sedimentation for both sediment types increased by factors of 2 to 4. The ionium method holds some promise as a dating technique for restricted areas of the deep ocean floor. Determination of ages in one core by the independent ionium and C^{14} methods exhibited satisfactory agreement. (auth)

8000

MEASUREMENT OF Li^6, He^3, AND H^3 IN METEORITES AND ITS RELATION TO COSMIC RADIATION. E. L. Fireman and D. Schwarzer (Brookhaven National Lab., Upton, New York). Geochim. et Cosmochim. Acta 11, No. 4, 252-62(1957).

The He^3 and Li^6 contents of six iron and five stone meteorites are measured by neutron activation. Both the iron and the stone meteorites have large He^3 contents ranging from 0.13×10^{-6} cc/g to 9×10^{-6} cc/g. The stone meteorites have Li^6 contents ranging from 1.1×10^{16} Li^6 atoms/g to 6.2×10^{16} Li^6 atoms/g. The iron meteorites have less than 10^{14} Li^6 atoms/g. There is no uniform relation between the Li^6 contents of the meteorites and their He^3 contents, indicating that the He^3 contents of both the stone meteorites and the iron meteorites are due to spallation caused by high-energy cosmic rays rather than slow neutrons and that the average slow-neutron flux has been less than 1 neutron/cm^2 sec. The tritium contents of the iron meteorites, Norfork (1918), Para de Minas (1934), and Charcas (1804) are measured. A tritium content of $(2.7 \pm 0.3) \times 10^6$ H^3 atoms/g at its time of fall is indicated for the Norfork meteorite and of $(5.9 \pm 1.2) \times 10^5$ H^3 atoms at its time of fall is indicated for the Para de Minas meteorite. There is less than 1.2×10^4 H^3 atoms/g in Charcas. The tritium and helium-3 content of Norfork combine to give it a cosmic-ray age of 0.9×10^9 years or greater. The tritium and helium-3 content of Para de Minas combine to give it a cosmic-ray age of 1.7×10^9 years or greater. This indicates that if iron meteorites resulted from the breakup of a large mass, the breakup occurred 0.9×10^9 or more years ago. Small H^3 contents but negligible helium-3 contents are found in terrestrial iron samples. The tritium content of the iron meteorites compared with that produced in iron by high-energy proton bombardment gives the average flux of cosmic rays bombarding the meteorite in extraterrestrial space. This flux as determined from the Norfork meteorite, equals the 1954 cosmic-ray flux which does not contain the low energy cutoff; the flux determined from the Para de Minas meteorite is a factor of 3 to 6 lower. This indicates that Para de Minas, which is a 112-kg meteorite, was shielded from cosmic radiation by material ablated during its passage through the atmosphere, or was irradiated by a smaller cosmic-ray flux than Norfork. (auth)

8001

NUCLEAR PROGRESSES IN GEOLOGIC SETTINGS. PROCEEDINGS OF THE SECOND CONFERENCE, HELD AT PENNSYLVANIA STATE UNIVERSITY SEPTEMBER 8-10, 1955. NUCLEAR SCIENCE SERIES REPORT NUMBER 19. Washington, National Academy of Sciences–National Research Council, 1956. 209p.

METALS AND METALLURGY

8002 BRB-35

Bridgeport Brass Co., Conn.

AUTOMATIC RECORDING OF VARIABLES IN DRAWING OF METALS. M. T. McGowan and R. M. Treco. Dec. 7, 1956. 23p. Contract AT(30-1)-1405. $0.35(OTS).

Dynamic measurement and recording of forces involved in drawing operations was accomplished with the installation of Brown Class 15 Electronik Recording Instruments on a Pilot Plant Hydraulic Draw Bench. Accurate evaluation of the relations of force with drawing stroke and velocity can be done simply and easily. The instrument is comprised of two recorders, enabling simultaneous recording of forces on the draw bar and plug rod during tube drawing. Rod drawing naturally requires use of but one recorder. Each recorder features a strain gage actuated measuring circuit for force measurement and a selsyn actuated chart drive for stroke measurement. (auth)

8003 HW-43745

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN INVESTIGATION OF THE CRACKING OF CONTINUOUS CALCINERS DURING FABRICATION. W. R. Smith and W. L. Walker. June 13, 1956. Changed from OFFICIAL USE ONLY May 22, 1957. 21p. Project CG-613. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

After final heat treatment during fabrication of continuous calciners, cracking was observed in base metal and welds. The cracking was found to be due to formation of a grain boundary eutectic though both metal and welding rod were from "good" heats of 347 stainless steel. Experiments which demonstrate the relative cracking tendencies

of 1-in. and $\frac{1}{4}$-in. thick sections of welded 304-L and 347 stainless steel are described. (T.R.H.)

8004 KAPL-M-AME-7

Knolls Atomic Power Lab., Schenectady, N. Y.

S3G INSTRUMENTATION BRAZING. Donald R. Hauprich. Mar. 15, 1957. 11p. Contract [W-31-109-Eng-52]. $1.80 (ph OTS); $1.80(mf OTS).

Inductance and resistance brazing techniques for brazing thermocouple sheaths and wires into S3G thermocouple receptacles are described. Good results were obtained in tests of the methods. (D.E.B.)

8005 NACA-TN-4003

Langley Aeronautical Lab., Langley Field, Va.

A VARIATIONAL THEOREM FOR CREEP WITH APPLICATIONS TO PLATES AND COLUMNS. J. Lyell Sanders, Jr., Harvey G. McComb, Jr., and Floyd R. Schlechte. Mar. 5, 1957. 23p.

A variational theorem is presented for a body undergoing creep. Solutions to problems of creep bending and creep collapse of plates, columns, beams, and shells can be obtained by means of the direct methods of the calculus of variations in conjunction with the stated theorem. The application of the theorem is illustrated for plates and columns by the solution of two sample problems. (auth)

8006 NP-6316

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

MECHANICAL PROPERTIES OF TITANIUM AND OTHER MATERIALS AT VERY LOW TEMPERATURES. Apr. 25, 1957. 29p.

Revision of Apr. 12, 1956 Memorandum of the same title.

A revised summary is presented of the available information on the mechanical properties of Ti at very low temperatures. Representative data are included for AISI Type 304 stainless and two aluminum alloys. Sources of information are listed under references. The data and the literature indicate that reasonable ductility and impact strength can be expected of unalloyed Ti at very low temperatures if the interstitial content is reasonably low, particularly the H content. Strength properties increase markedly as the temperature is decreased. The A-110AT and Ti-6Al-4V alloys may also possess reasonable impact strength at very low temperatures, since the data indicate that the ductile-to-brittle transition temperature for these materials is slightly above room temperature. At the lowest temperatures listed, the impact strength of these two alloys is still acceptable. RC-130A also seems to have appreciable impact strength at low temperatures. The scatter in the data indicate that it may be desirable to perform the necessary mechanical tests on the actual material that will be used for any specific application. Testing techniques that have proven successful at very low temperatures are described. (auth)

8007 NP-6320

Clevite Research Center, Cleveland.

RESEARCH ON THE LUBRICATION OF TITANIUM. Quarterly Progress Report No. 4 [for] February 15, 1957 to May 14, 1957. N. Fatica. May 16, 1957. 37p. Project No. 50167-G. Contract AF33(616)-3350.

All of the tests conducted on the Shell Four-Ball Wear Tester at constant speed and load were evaluated on the basis of wear resistance. It was found that there are at least 25 metal-lubricant combinations that warrant further consideration. About one-third of the combinations employed Ti coated with electroless Ni, which gave excellent wear in all lubricants tested. Second in rank is cyaniding which, with few exceptions, gave excellent results also. Third is nitriding, and fourth is carburizing. Of all the lubricants tested, Halocarbon 11-14 gave the highest level of performance, while conventional lubricants like Mobiloil SAE 30 gave the worst. Of the resin-bonded coatings, Kel-F showed no sign of wear at room temperature; the others were worthless. All resin-bonded coatings failed at elevated temperatures. An attempt was made to correlate friction coefficients with wear with some success. Recommendations for future tests have been made with respect to both treatments and lubricants. Preliminary results on the Falex Tester are also reported. (auth)

8008 NRL-4928

Naval Research Lab., Washington, D. C.

INVESTIGATION OF THE CREEP-RUPTURE PROPERTIES OF Mo-V LOW-ALLOY STEELS. Paul Shahinian and Joseph R. Lane. Apr. 1, 1957. 24p. Projects NR 510-007; NS 013-120; and NA 230-038.

Creep-rupture properties were determined for low-alloy steels containing higher V and less Mo contents than several of the standard types now in use. The steels were tested at 900 and 1100°F in the normalized and normalized-and-tempered conditions using austenitizing temperatures of 1800, 1950, and 2000°F. It was necessary to normalize from a high temperature, 1950°F, to realize an improvement in strength from the higher V additions. The high-V steels (0.5 to 0.7%) were superior to the low-V type (0.2%) at 1100°F in both strength and ductility. A reduction in Mo content was effected without lowering strength at 1100°F. (auth)

8009 WADC-TR-56-521

Vitro Labs., West Orange, N. J.

PREPARATION OF PROTECTIVE COATINGS BY ELECTROPHORETIC METHODS. [Period covered] July 1955 to July 1956. Allen C. Werner, James J. Shyne, Harold N. Barr, and Bernard Triffleman. July 31, 1956. 52p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-3118. (AD-118224).

An investigation was conducted of the preparation of oxidation-resistant coatings for Mo by electrophoretic methods. Multilayer coatings of 80% Ni-20% Cr and Ni-bonded Cr_3C_2 provided good static air-oxidation resistance. Inclusion of a 50% dense Ni-Cr layer resulted in satisfactory ballistic impact resistance. Erosion was fair. All the test panels failed under severe thermal shock. Electrokinetic impregnation of graphite to provide increased oxidation resistance was unsuccessful, a maximum impregnation of 2.1% by weight being obtained. The effect of varying suspension concentration, impregnation voltage, periodic reversal of the current, activators for the graphite and the suspensions and the use of ultrasonic energy were studied. Impregnation up to 2.6% by weight was obtained by pumping a slurry through graphite without application of any emf. (auth)

8010 WADC-TR-56-550

Battelle Memorial Inst., Columbus, Ohio.

DEVELOPMENT OF HIGH-STRENGTH FILLER WIRES FOR WELDING SAE 4130, 4140, AND 4340 STEELS. Period covered: March 1, 1954 to June 30, 1956. Herbert W. Mishler and Raeman P. Sopher. 75p. Project title: METALLIC MATERIALS. Task title: WELDING, BRAZING, AND SOLDERING OF METALS. Contract AF33(616)-2339. (AD-118210).

Filler wires were developed for welding high-strength low-alloy aircraft steels by the inert-gas W-arc and inert-gas consumable-electrode processes. The major factors that were considered in the evaluation and development work were: weld-metal porosity, weld-metal cracking tendency, heat-treatment response compared with base metal, strength of heat-treated weld joint, weld-metal

toughness, and weld-metal hardenability. Two filler wires were developed for welding each of the three steels, SAE 4130, 4140, and 4340. One of each pair of filler wires had a composition similar to the base material, while the other was of a dissimilar composition. Sound, crack-free welds, heat treatable to 200,000 psi were deposited under a high degree of restraint with all these filler wires. The best results were obtained with the filler wires of compositions similar to the base material, although satisfactory welds were made also at most of the strength levels with the dissimilar filler wires. (auth)

8011 WADC-TR-57-40

Michigan. Univ., Ann Arbor. Engineering Research Inst. AN INVESTIGATION OF THREE FERRITIC STEELS FOR HIGH-TEMPERATURE APPLICATION. [Period covered] September 15, 1955 to December 15, 1956. A. Phillip Coldren and James W. Freeman. Jan. 8, 1957. 117p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-3239. (AD-118204).

An investigation was carried out to survey the relationships between microstructure and properties at 700 to 1100°F for low-alloy, hardenable steels. A Ni–Cr–Mo (SAE 4340) and two Cr–Mo–V ("17-22-A"S and "17-22-A"V) steels were studied. The results, together with those presented in References for previous work on 4340 and "17-22-A"S steels, correlate properties with microstructure for three temperatures of isothermal transformation in the pearlite region and three in the bainite region. Oil-quenched and normalized structures were included for comparison. The properties were evaluated for these structures when tempered to both the 300 and 350 Brinell hardness levels. Data for the "17-22-A"V steel in the form of a TTT diagram obtained to establish heat-treating condition are included. These data are supplemented by similar studies for continuous cooling down to rates simulating the air cooling of a 6-in. round. The influence of increasing the heat-treating temperature was also studied. Controlled mixed structures were developed by transforming about 50% in the upper bainitic range and about 50% in the lower bainitic range. The results of a very limited start for a study of hot-working condition effects are included. The results are correlated and analyzed. Optimum structures (or treatments) vary with both the alloy and test conditions. In general, bainitic structures of one type or another gave best properties. However, for the Cr–Mo–V steels, pearlites formed at relatively low temperatures were often as strong or stronger than the bainites. Tempered martensite was never the strongest structure and most often was the weakest. (auth)

8012 AEC-tr-2923

THE USE OF BERYLLIUM IN LIGHT METALS. E. A. Smith, Jr. and E. A. Giessen. Translated by D. E. Cardamone from Metall 9, 198-9(1955). 5p.

8013

ON RADIATION-INDUCED IRREVERSIBLE CHANGES IN METALS AND ALLOYS AND THE "TEMPERATURE-SPIKE" CONCEPT OF RADIATION DAMAGE. Roger Chang (Rutgers Univ., New Brunswick, N. J.). Acta Met. 5, 275-80(1957) May.

The temperature distribution in the immediate neighborhood of a primary knockon between fast neutrons and a heavy metal, or the "temperature spike," is calculated and correlated with the induced irreversible changes in the metal. The experimental observations of Kernohan on radiation-enhanced precipitation of Ni-Be compound in a supersaturated solid solution of Be in Ni and of Reynolds on radiation instability of austenitic-type 347 stainless steels can both be successfully interpreted this way. Further studies are in need to consolidate the "temperature spike" concept of radiation damage. (auth)

8014

METAL FATIGUE IN CONTACT FRICTION. V. S. Ivanov and I. A. Oding. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 1, 95-102(1957) Jan. (In Russian)

Investigations made of Cr–Ni–Mo friction fatigue limits are reported. Tests in molecular hydrogen media did not reveal any improving effects on the fatigue limits. Experiments up to 250 million cycles showed a steadily reducing tensile strength in both air and hydrogen media. Data developed by the Weibull method for Cr–Ni–Mo alloy fatigue limits in friction contact are equal to zero. The low fatigue limit is caused by the electroerosion process resulting from thermoelectrical current formed by friction and pulsation according to the changes in contact resistance. Changes in the direction of the thermoelectric current, by selecting contact materials or by countercurrent can retard or eliminate electroerosion and improve the fatigue limits. The mechanism of fatigue rupture in contact friction is based on the formation of vacancies in the crystal lattice during the electroerosion metal transfer. (R.V.J.)

8015

TITANIUM–TUNGSTEN–ALUMINUM ALLOYS. N. T. Gudtsov and I. P. Panchenko. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 139-43(1957) Feb. (In Russian)

The microstructure, hardness, durability, and heat resistance of Ti with 3% Al and 5, 10, and 15% W were tested. It has been found that the mechanical properties of the above alloys improve in the temperature interval of 400 to 600° and their hardness increases at room temperature with the increase of W. The wear resistance improved with increased amounts of W. (R.V.J.)

8016

MODIFICATIONS OF CARBIDE PHASES IN Ti ALLOYS. G. P. Danilova, E. A. Kamenskaya, and M. V. Mal'tsev. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 150-2(1957) Feb. (In Russian)

Tests were made of carbide phases in titanium (Ti 98.1%, Fe 0.04%, Mg 0.3%, Cl 0.06%, Si 0.08%, and C 0.03%) and Ti–Nb melted in induction furnaces. Additions of B, Mo, W, V, Zr, Ni, and Te were used separately or in combination with B to modify the carbide phases of the alloys. The admixtures induced finer and more uniform microstructures. Small amounts of modifying materials (0.05 to 0.2%) showed the best results; the changes in the structure considerably improved the impact ductility of Ti and Ti–Nb alloys. The tests open new possible applications of C–Ti alloys in compression fabrication and in uses of induction furnaces. (R.V.J.)

8017

ANODIC OXIDATION OF ALUMINUM, CHROMIUM, HAFNIUM, NIOBIUM, TANTALUM, TITANIUM, VANADIUM, and ZIRCONIUM AT VERY LOW CURRENT DENSITIES. Herman A. Johansen, George B. Adams, Jr., and Pierre Van Rysselberghe (Univ. of Oregon, Eugene). J. Electrochem. Soc. 104, 339-46(1957) June.

Some aspects of the mode of formation of anodic oxidation films in the potential region below oxygen evolution were examined for a number of metals under as nearly constant experimental conditions as possible. The metals selected were Al, Ti, Hf, V, Nb, Ta, and Cr. Results for Zr were reported in earlier publications. Electrolytic parameters and formation fields were evaluated from the unitary formation rates. Local currents were estimated using the method described previously. (auth)

8018

PREPARATION OF THORIUM BISMUTH DISPERSIONS FROM ELECTROLYTIC THORIUM. M. E. Sibert and

M. A. Steinberg (Horizons Inc., Cleveland, Ohio) and R. J. Teitel (Dow Chemical Co., Midland, Mich.). J. Electrochem. Soc. 104, 374-8(1957) June.

The preparation of Th_3Bi_5 dispersions in liquid Bi utilizing electrolytic Th has been investigated by three techniques. These materials are potentially useful as fuels for liquid metal reactors. Dispersions have been prepared successfully in desired concentration, particle size, and shape by addition of crushed Th cathode deposits to Bi, addition of as-deposited cathode to Bi in the cell, and by electrolysis of $ThCl_4$ using a liquid Bi cathode. Procedures, conditions, and results are fully described. (auth)

8019

EMISSION SPECTRA OF ACTINIUM. William F. Meggers, Mark Fred, and Frank S. Tompkins. J. Research Natl. Bur. Standards 58, 297-315(1957) June.

Small samples of actinium, produced by transmuting radium, have been investigated spectroscopically by photographing the spectra of light emitted by the samples when excited in a hollow cathode or in arcs and sparks between copper or silver electrodes. The wavelengths were measured, and intensities estimated, for some 500 lines characteristic of actinium in the spectral range 2062.00 to 7886.82 A. A comparison of line characteristics in different sources permitted sorting into five categories; about 140 lines belong to Ac I, more than 300 were ascribed to Ac II, 8 were definitely assigned to Ac III, 5 may belong to Ac IV, and about 80 represent band heads characteristic of AcO, the actinium-monoxide molecule. Analyses of the first three spectra of actinium have revealed their most important features, including atomic-energy levels, spectral terms, and electron configurations. The ground state of Ac III is found to be $(7s)^2S_{0}½$, that of Ac II is $(7s^2)^1S_0$, and that of Ac I is $(6d7s^2)^2D_{1½}$. Comparisons of the analogous spectra of the chemical homologs (scandium, yttrium, lanthanum, and actinium) show that actinium closely resembles yttrium, except that additional terms of odd parity, first found in lanthanum spectra and attributed to the 4f electron, are also found in actinium spectra, where they provide evidence of the presence of the 5f electron. The binding force on the 4f electron in La II is much stronger than on 5f in Ac II. The principal ionization potential of Ac^+ ions is about 12.0 electron volts. (auth)

8020

THE DEVELOPMENT OF THE IODIDE PROCESS OF REFINING TITANIUM AND ZIRCONIUM. R. A. J. Shelton (Univ. of Manchester). Metallurgia 55, 225-31(1957) May.

The van Arkel or iodide process for the refining of titanium and zirconium owes much to workers in the incandescent lamp field. Following a description of van Arkel's apparatus, the author traces the hot filament technique from the carbon filament lamp, through the metal filament lamp and the preparation of single crystals of metals such as tungsten, to its application by van Arkel to the purification of titanium and zirconium by the dissociation of the tetraiodides. (auth)

8021

RECOVERY POTENTIALS FOR MOLTEN SYSTEMS OF LiCl–KCl, AND LiCl–$BaCl_2$. A. A. Kolotiĭ and Yu. K. Delimarskiĭ. Zhur. Priklad. Khim. 30, 406-41(1957) Mar. (In Russian)

Recovery potentials from eutectic and equimolar complexes of LiCl–KCl and LiCl–$BaCl_2$ at various temperatures were studied. It was found that eutectic compounds are more amenable to electrolytic recoveries of Li. The difference of LiCl–$BaCl_2$ recovery potentials at temperature intervals of 550 to 700° was about 0.21 to 0.27 v, while the difference for LiCl and KCl in the same temperature interval was only 0.11 to 0.17 v. The disadvantage of the LiCl–$BaCl_2$ system is its high melting point. Experiments showed that metallic Li recoveries from chlorides should be carried out at the lowest possible temperatures. (R.V.J.)

8022

ABSORPTION AND IONIZATION OF SODIUM ON HOT TUNGSTEN. A. M. Romanov and S. V. Starodubtsev (Leningrad Inst. of Physics in Technology). Zhur. Tekh. Fiz. 27, 722-33(1957) Apr. (In Russian)

Evaluations were made of various experimental factors interfering or disguising the true properties of Na absorption and ionization on hot W. The tests were made with pure W and measurements were taken at a wide range of Na vapor pressures. (R.V.J.)

8023

PASSAGE OF POSITIVE IONS OF Li THROUGH THIN LAYERS OF POWDERED Al. V. V. Belyakov and M. A. Mittsev (Leningrad Zhdanov Univ.). Zhur. Tekh. Fiz. 27, 803-4(1957) Apr. (In Russian)

The penetration of Li^{++} ions through prepared plates of Al and Au was measured with a mirror-type galvanometer of $\sim 10^{-9}$ a/mm. Results show that Li ions with energies of 1 to 2 kev are able to penetrate more than ten layers of Al atoms. (R.V.J.)

Refer also to abstract 7973.

PHYSICS

8024 APEX-299

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SUMMARY OF DRAG COEFFICIENTS OF VARIOUS SHAPED CYLINDERS. C. F. Heddleson, D. L. Brown, and R. T. Cliffe. Apr. 1957. 56p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.40(OTS).

8025 NP-6319

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

QUARTERLY PROGRESS REPORT NO. 45 FOR PERIOD ENDING FEBRUARY 28, 1957. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Apr. 15, 1957. 182p. DA Project No. 3-99-00-100. Contract DA36-039-ac-64637.

Research and engineering progress is reported in the fields of physical electronics, microwave gaseous discharge, solid state physics, microwave spectroscopy, nuclear magnetic resonance and hyperfine structure, microwave electronics, frequency modulation, statistical communication theory, processing and transmission of information, transistor and diode research, speech analysis, mechanical translation, communications biophysics, neurophysiology, circuit theory, network synthesis, microwave theory, and statistical thermodynamics. (For preceding period see NP-6236.) (D.E.B.)

8026 AEC-tr-2721

DIELECTRIC MEASUREMENTS USING MILLIMETER WAVES. V. Sarafanov. Translated from Uspekhi Fiz. Nauk 55, 127-31(1955). 4p.

The use of millimeter waves to investigate the properties of dielectrics is briefly reviewed. (B.J.H.)

8027

ON THE THEORY OF LIQUIDS. Louis Goldstein (Los Alamos Scientific Lab., N. Mex.). Annals of Physics 1, 33-57(1957) Apr.

The exact analytic forms of correlation functions of liquids and some of their macroscopic properties which

these correlations determine are discussed. Since these functions are expressible in terms of the scattering structure factors of liquids, the macroscopic properties they define will be described in terms of the properties of the structure factors. One is then led, with some limitations, to a rigorous result on the behavior of pair potential energies of isolated stationary atoms at close separations. Part of the paper is devoted to a discussion of some of the limitations of the experimentally derived structure factors as well as the liquid correlation functions to which they give rise. It will be shown, on the basis of liquid helium data, that improvements in the empirical correlation functions as well as the various macroscopic liquid properties they define, require the knowledge of the structure factors over a far wider range of the momentum changes on scattering than obtained heretofore. The final topic concerns a detailed study of the asymptotic, large atomic separation, behavior of the correlation functions. The temperature limitations of a direct method yielding these asymptotic forms will be obtained. A new method of derivation of these forms, involving the scattering structure factors, will be described. This same method also leads to the asymptotic form of the structure factors themselves, at large values of the momentum changes on scattering. These latter asymptotic structure factors retain their validity over the temperature interval of existence of liquids. (auth)

8028

MEASUREMENTS OF SATURATED VAPOR PRESSURE OF SOLID BISMUTH BY ISOTOPE EXCHANGE METHOD. An. N. Nesmeyanov, B. Z. Iofa, and B. V. Karasev. Doklady Akad. Nauk S.S.S.R. 112, 882-5(1957) Feb. 11. (In Russian)

Pressure measurements of saturated vapor over solid metal are useful for calculations of thermodynamic functions important in planning of atomic power stations in which bismuth can be used as the heat transfer agent. The pressure measurements of solid bismuth saturated vapor were made by the exchange method with Bi^{210}(RaE) as radioactive indicator. The RaE was released from old emanation tubes (3 curie radon) and purified from RaD and Po. The design of vacuum apparatus and exchange chambers with special heating furnaces are shown. Results of the experiments in tabulated and graphic forms are included. (R.V.J.)

8029

THE SOLUBILITY OF SOLIDS IN GASES. George W. Morey (Carnegie Inst. of Washington, D. C.). Econ. Geol. 52, 225-51(1957) May.

That gases can dissolve solids has been known since the work of Hannay in 1879–1881. The historical and theoretical aspects of this phenomenon are discussed, and the literature of the subject is summarized and reviewed. Some previously unpublished results from the Geophysical Laboratory on the solubility of UO_2, Al_2O_3, NiO, Nb_2O_5, Ta_2O_5, BeO and GeO_2 at 500°C, 1,000 bars steam pressure, are included. (auth)

8030

THE THERMOLUMINESCENCE OF CaF_2:Mn. Robert J. Ginther and Russell D. Kirk (U. S. Naval Research Lab., Washington). J. Electrochem. Soc. 104, 365-9(1957) June.

The thermoluminescence of manganese-activated calcium fluoride has been found to be dependent on both its manganese content and the presence of other foreign ions. Sodium and oxygen promote high temperature glow peaks, whereas the addition of trivalent cations causes the thermoluminescence of oxygen-containing material to occur at lower temperatures. Thermoluminescence may be excited by x-rays, by mechanical handling, or by irradiation with blue light. Glow peak positions are independent of the method of excitation. (auth)

8031

THE PROCEEDINGS OF THE SOLAR FURNACE SYMPOSIUM, HELD JANUARY 21 AND 22, 1957, AT PHOENIX, ARIZONA. J. Solar Energy Sci. Eng. 1, No. 2 and 3, (1957) Apr.-July.

Papers are included on applications, economic factors, fuel, industrial considerations, uses, materials and surfaces, and design problems of solar furnaces, design and construction of the Quartermaster Furnace, the Arizona State College Furnace, and the heliostat mirror, the manufacture of parabolic mirrors, high temperature and new materials, control of thermal radiation from a high temperature source, temperature and flux vs. geometrical perfection, measurement of the spectral intensity distribution of a convergent high-intensity light beam, and a survey of installations in the U. S. (M.H.R.)

8032

STUDIES ON THE DISSOCIATION CONSTANT OF THE FLUOBERYLLATE (BeF_4^{2-}) ION BY THE METHOD OF ION-EXCHANGE. Asit Kumar Ray. Naturwissenschaften 44, No. 9, 279(1957).

It was found by the method of ion-exchange that in presence of a large excess of fluoride ions, Be ions exist in solution in the form of anionic, BeF_4^{2-}, complex. At lower fluoride concentrations there is no evidence of the existence of BeF_3^- ion in aqueous solution. (auth)

8033

ON THE ACTIVATION ENERGY OF HIGH TEMPERATURE CREEP IN METALS. Paul Feltham (Univ. of Leeds). Phil. Mag. (8) 2, 584-8(1957) May.

The temperature dependence of the activation volume or 'stress-concentration factor' q appearing in the expression $d\epsilon/dt = A \exp(-H/kT) \sinh(q\sigma/kT)$ relating the equilibrium tensile creep rate $d\epsilon/dt$, the temperature T and the applied tensile stress σ has been studied in the case of several pure metals subject to creep above about $\frac{1}{2}T_m$, where T_m is the melting point. On writing $q = nb^3$, where b is the distance of closest approach of atoms in the lattice, the relation $n = n_0 \exp[-Q/kT(1-T/T_m)]$ was found to be valid in all cases, with $Q = \alpha T_m$ and $\alpha = 4.9$ (cal/g atm)/°K, i.e., Q is equal to about twice the latent heat of melting. The increase of q with temperature is ascribed to the increase in the mean spacing between adjacent logs in screw dislocations, and Q appears to be the activation energy for the conservative motion of jogs along dislocations. In face-centered cubic metals large values of n_0 are found to be associated with low stacking fault energies, and vice versa. (auth)

8034

THE MAGNETIC SUSCEPTIBILITY OF YTTERBIUM FROM 1.3°K TO 300°K. J. M. Lock (Radar Research Establishment, Malvern, Worcs.). Proc. Phys. Soc. (London) B70, 476-80(1957) May.

The susceptibility of ytterbium metal has been measured at room temperature and between 1.3 and 80°K. Its magnitude seems to indicate that the atoms are mostly in the ^1S state with 4f shell completely filled, only about 1 atom in 260 being in the $^2F_{\frac{7}{2}}$ state with 13 electrons in the 4f shell. The paramagnetic saturation effect at the lowest temperatures seems to confirm this. The material has been tested for superconductivity down to 1.24°K in fields as low as 10 oersteds, with a negative result. (auth)

8035

SHOCK TUBES. A. Knowler. Research (London) 10, 132-7 (1957) Apr.

Flow in shock tubes and impulse tunnels is analyzed. Applications of shock tubes and running time measurements are discussed. (J.E.D.)

8036

NEW WORKS IN PHYSICS. Vestnik Akad. Nauk S.S.S.R. 27, No. 4, 110-11(1957) Apr. (In Russian)

A review is given of reports presented to the Physics and Mathematics Conference, Feb. 21, 1957. The relationship of atoms of various elements to electrons and the effects of such relationship on the outer structure of the electron shell was discussed by V. M. Dukel'skiĭ; investigations of new semiconductors of complexes with sphalerite and wurthite were described by N. A. Goryunova; the theory of molecular force attractions between solid bodies, and the theory of magnetic properties of super conducting alloys not based on macroscopical heterogeneities were discussed by E. M. Lifshits and A. A. Abrikosov, respectively. (R.V.J.)

AEROSOLS

8037 NYO-4752

Columbia Univ., New York.

SIZE SEPARATION OF AEROSOL PARTICLES BY AN ELECTROSTATIC DISCRIMINATOR. Final Report [for] September 1, 1955–September 15, 1956. Vadim G. Drozin. [Mar. 12, 1957]. 17p. Contract AT-(30-1)-1434. $0.20(OTS).

Data are presented on the size separation of aerosol particles made of the same material, in size range of 0.2 to 0.6 μ. Investigations were made with sliding and laminar flow precipitators. (For preceding period see NYO-4603.) (R.V.J.)

8038

DEPOSITION OF AEROSOL PARTICLES ON STREAMLINED CYLINDER BY ELECTROSTATIC ATTRACTION. G. L. Natanson (Karpov Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 112, 696-9(1957) Feb. 1. (In Russian)

Calculations are made of the aerosol particle deposition effect on a charged cylinder with charged particles, on charged cylinder with uncharged particles, and on an uncharged cylinder with uncharged particles. The Van der Waals interaction effect between the cylinder and particle in the aerosol filtration through fiber materials has been recalculated. (R.V.J.)

8039

CRITICAL COMPARISON OF COLLECTION EFFICIENCIES OF COMMONLY USED AEROSOL SAMPLING DEVICES. Conrad Schadt and R. D. Cadle (Stanford Research Inst., Menlo Park, Calif.). Anal. Chem. 29, 864-8(1957) June.

Information is given on performance of aerosol sampling devices with different aerosols under various conditions of operation. Sampling devices used are: thermal precipitator, jet impactor, Greenburg-Smith impinger, electrostatic precipitator, membrane filter, and sedimentation box. Marked discrepancies are often observed between theoretical and observed efficiencies. (auth)

ASTROPHYSICS

8040

STELLAR ENERGY SOURCES. E. E. Salpeter (Cornell Univ., Ithaca, N. Y.). Revs. Mod. Phys. 29, 244-54(1957) Apr.

Thermonuclear reactions and the way in which they affect the evolution of individual stars are discussed. Topics are included on astrophysical observations, stellar interior calculations, main sequence stars, an evolutionary scheme, early gravitational contraction, thermonuclear reactions with hydrogen, thermonuclear reactions without hydrogen, the evolution of population II red giants, and stellar explosions. (M.H.R.)

COSMIC RADIATION

8041

CONCERNING THE DISINTEGRATION OF HEAVY NUCLEI OF NUCLEAR EMULSION BY PARTICLES OF COSMIC RADIATION. K. Lanius. Nuclear Physics 3, 391-422 (1957) May. (In German)

A detailed investigation of 1020 disintegration stars, with 1 to 5 prongs, of the heavy nuclei in nuclear emulsion is reported and the results compared with the theoretical model of a nucleon cascade followed by evaporation. The observed frequencies of the emitted α particles and deuterons are many times larger than the theoretical expectation. The angular distributions and angular correlations as well as the energy spectra of these particles are also in disagreement with the theoretical model. The behavior of the protons is approximately explained by the model 70% of the stars have recoil tracks with range < 6 μ. Their range distribution, angular distribution and angular correlations are only partially accounted for by the theory. (auth)

8042

CHANGES IN THE HIGH-LATITUDE EAST-WEST ASYMMETRY OF COSMIC RAYS. R. M. Jacklyn and A. G. Fenton (Univ. of Tasmania, Hobart, Australia). Phys. Rev. 106, 809-11(1957) May 15.

A large long-term decrease in the east-west asymmetry has been observed at Hobart (λ = 52°S; near sea level). This is apparently related to the level of solar activity. In 1950 the asymmetry amounted to $\alpha = 0.0246 \pm 0.0022$, while in 1954 (a year of sunspot minimum) it was only 0.0108 ± 0.0016. It is shown that the decrease cannot be explained by changes in the parameters involved in the Johnson theory of the high-latitude east-west asymmetry, leading to the conclusion that the primary particles capable of producing a sea-level penetrating component at these latitudes are not completely isotropically distributed when they reach the upper atmosphere. The asymmetry is to be regarded as a very sensitive indicator of such anisotropy. (auth)

8043

ON THE ORIGINS OF COSMIC RAYS. Philip Morrison (Cornell Univ., Ithaca, N. Y.). Revs. Mod. Phys. 29, 235-43(1957) Apr.

Among the suggested sources of cosmic radiation is that of electron synchrotron radiation of extremely high energy from the various nebulae. Photographs of these nebulae through different filters and a radio source intensity graph are included in support of this theory. (M.H.R.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

8044

SMALL ANGLE SCATTERING FROM DEFORMED METALS. H. H. Atkinson (Cavendish Lab., Cambridge, Eng.) and R. D. Lowde (A.E.R.E., Harwell, Berkshire). Phil. Mag (8) 2, 589-90(1957) May.

Neutron scattering from deformed metals was measured and compared with previous work using x rays. Since this scattering cross section is equivalent to less than one per cent of the previous observations, it is concluded that 99% of the reported effect was due to processes other than true small angle scattering from defects in the volume of the metal. (M.H.R.)

8045

MAGNETIC PROPERTIES OF NEODYMIUM SINGLE CRYSTALS. D. R. Behrendt, S. Legvold, and F. H. Spedding

(Iowa State Coll., Ames). Phys. Rev. 106, 723-5(1957) May 15.

Magnetic measurements have been made on single crystals of neodymium which were grown by the Bridgman technique. At 20.4°K and above, the susceptibility obtained with the field perpendicular to the c_0 axis of the hexagonal crystal is greater than that obtained with the field parallel to the c_0 axis. In this same temperature range no anisotropy is observed in the basal plane. At 4.2°K antiferromagnetic ordering is indicated by the data and magnetic anisotropy in the basal plane is observed. (auth)

8046

ACHIEVEMENTS IN SOVIET ELECTRON DIFFRACTION WORKS. S. A. Semiletov. Vestnik Akad. Nauk S.S.S.R. 27, No. 4, 112-4(1957) Apr. (In Russian)

A review is given of reports on electron diffraction presented at the conference at Moscow Inst. of Crystallography, Jan. 22 to 26, 1957. (R.V.J.)

ELECTRICAL DISCHARGE

8047 AEC-tr-2710

AN INVESTIGATION OF PARTIAL (HIGH FREQUENCY) DISCHARGES THROUGH OILED PAPER INSULATION. G. S. Kuchinskii (Kuchinsky). Translated from Zhur. Tekh. Fiz. 25, 1209-16(1955). 7p.

During the operation and testing of electrical machines and equipment localized damage of the insulation occurs, which is accompanied by partial discharge. The detection of this damage is highly desirable since such damaged spots lead to punctures and accidents. In this investigation of samples of impregnated condenser paper, the fundamental laws and causes of partial discharges are given. (auth)

8048 AEC-tr-2723

SELF-EXCITED OSCILLATIONS IN THE POSITIVE COLUMN OF A GASEOUS DISCHARGE. M. E. Gertsenshtein. Translated from Zhur. Eksptl.' i Teoret. Fiz. 23, 669-77 (1952). 11p.

The criteria for self-excited oscillations in a plasma are ascertained. The oscillation properties of the plasma are determined from the sum of the electron and ion distribution functions in which the ion function appears with the coefficient m/M; for self-excited oscillations to occur it is necessary that the sum have at least two maxima. It is shown that for small phase velocities the ions play a more important role than the electrons. (auth)

8049 AEC-tr-2726

SPACE PERIODICITY OF GAS DISCHARGES. A. A. Logunov. Translated from Zhur. Eksptl.' i Teoret. Fiz. 20, 458-64(1950). 10p.

An equation is set up for the distribution function for electrons in a plasma taking into account the recombination of electrons, ionization, and excitation of molecules and atoms of the gas, and taking into account as well electron collisions with atoms and molecules which produce scattering of the electrons. A particular case is investigated taking into account only diffusion as applied to the problem of the space periodicity of the gas discharge. Periodic solutions for the electron density are obtained using a linear approximation. (auth)

8050 AEC-tr-2728

OSCILLATIONS OF AN ELECTRON PLASMA. L. Landau. Translated from Zhur. Eksptl.' i Teoret. Fiz. 16, 574-86 (1946). 16p.

The oscillograms of an electron plasma arising as a result of an arbitrary initial non-equilibrium distribution are considered. It is shown that the oscillations of the field in the plasma are always damped; the relation between the frequency, the attenuation factor and the propagation vector are determined for both large and small values of this vector. The penetration of an external periodic electric field into the plasma is analyzed. The behavior of the field well within the plasma is examined. The case in which the frequency of the external field is close to resonance with the natural plasma frequency is considered separately. (auth)

8051 AEC-tr-2731

POSITIVE COLUMN OF A GAS DISCHARGE IN AN AXIALLY-SYMMETRIC INHOMOGENEOUS MAGNETIC FIELD. E. M. Reikhrudel. Translated from Zhur. Tekh. Fiz. 21, 733-45(1951). 13p.

An investigation has been made of the effects of an external inhomogeneous magnetic field on the motion of electrons in the plasmas of a glow discharge and an arc discharge at various currents and pressures. A probe was used in conjunction with a sectionalized anode. It has been established that the external magnetic field, in perturbing the electron motion, gives rise to a number of new effects in the discharge plasma. It has been found that in an inhomogeneous magnetic field produced by magnetic lenses, the following effects occur: 1) a redistribution of the directions of the electron currents in the plasma; 2) a redistribution over coordinates of the electron density in the plasma; 3) a perturbation of the electron velocity distribution and a change in the electron temperature. A highly inhomogeneous magnetic field, by reducing the concentration of charged particles in the plasma layer close to the probe, tends to increase the dimensions of this layer. Under these conditions the shielding effect of the layer is weakened and the possibility arises of controlling the discharge current by varying the potential of the probe. (auth)

8052 AEC-tr-2732

A STUDY OF THE FAST ELECTRONS IN A PLASMA. L. G. Guseva. Translated from Zhur. Tekh. Fiz. 21, 427-37(1951). 12p.

The energy distribution of fast electrons in a positive column discharge in mercury vapor was studied. In order to obtain reliable results, probes of specific designs which would introduce the least disturbance in the discharge were used. In addition, the spontaneous electric oscillation in the region between the probe and the anode is damped by a constant magnetic field. It was found that the energy distribution is Maxwellian for electrons with energy considerably higher than the ionization energy. The characteristic variations of the electron current curve, obtained by a flat probe at low pressure and low discharge current, are caused by the presence of a layer of space charges, near the walls of the discharge tube, constituting an appreciable fraction of the radius of the column. Using all of the necessary precautionary measures, the experimental determination of the average number of ionizations produced by each electron of the plasma showed that the results agree with the theoretical data calculated from the value of T_e and the shape of the curve of effective ionization. This fact is a reliable proof of the accuracy and reality of the value of T_e obtained by the probe measurements. The inelastic collision of the electrons with the atoms plays an important role in the mechanism of gaseous discharge. These collisions are caused by electrons with sufficient energy. The analysis of the probe measurement characteristics makes it possible to study the energy distribution of the electrons. There are however, up to the present time, only probe measurements which can obtain the distribution function of the slow electrons (with energy usually less than the ionization energy). The study of the electron current properties in probe measurements for fast electrons has encountered a number of difficulties. The purpose of this paper is to

directly study by experimentation the energy distribution function of electrons in the high energy region. (auth)

8053 AEC-tr-2734
PLASMA EMISSION OF A GLOW DISCHARGE IN MOIST AIR. K. S. Garger. Translated from Zhur. Tekh. Fiz. 20, 1413-21(1950). 12p.

The spectrum of the emission from the positive column of a glow discharge in air with added water vapor from 10^{-5}% H_2O to 50% H_2O; for wavelengths between 2800 and 7300 A; pressures from 0.5 to 40.0 mm Hg, and current strengths from 0.5 to 10.0 ma was investigated. On the basis of the discovered high sensitivity to humidity changes, of the relative intensity of the H_α line and the neighboring bands of the first nitrogen positive system, a method of determining the amount of water vapor in air at reduced and normal pressure was developed. The limits of the reliable measurements are from 0.02 to 2.0% H_2O, with an associated error of 4 to 10%. The dependence of the relative intensity of the H_α and the N_2 bands on the pressure of the mixture, the spectrograph slit width and current strength was studied. As a result of discharge spectrum investigations, it is assumed that water vapor dissociates into atomic hydrogen and hydroxyl, while oxygen appears as a consequence of secondary processes. Metastable molecules $N_2(A^3\Sigma)$ must play an important role in the dissociation of H_2O and excitation of H. Possible uses of the results obtained and ways of improving the procedures and accuracy of the results are indicated. (auth)

8054 AEC-tr-2740
WAVES IN CLYINDRICAL PLASMAS. R. L. Stratonovich. Translated from Vestnik Moskov. Univ., Ser. Fiz. Mat. i Estestven. Nauk, No. 3, 31-40(1952). 12p.

Plane longitudinal waves in a plasma limited by the side walls of a cylindrical discharge tube with radius a are studied using a cylindrical coordinate system. The discussion is limited to linear approximations that hold for small amplitudes. In examining the variable component, the inhomogeneities of a micropole are neglected. Nonequilibrium processes and the effect of the finite length of tube are not considered. (M.H.R.)

8055 AEC-tr-2747
CHARACTERISTICS OF PROBES AT POSITIVE POTENTIALS AND THE MEASUREMENT OF GAS DENSITY DURING A DISCHARGE. B. N. Klyarfeld, A. A. Timofeev, N. A. Neretina, and L. G. Guseva. Translated from Zhur. Tekh. Fiz. 25, 1581-96(1955). 15p.

Discharges connected with a probe which is at a positive potential with respect to the plasma are reviewed. The utilization of certain aspects of the current-voltage characteristics of such probes makes it possible to measure the change of gas density due to a d-c or a-c discharge. (auth)

8056 AEC-tr-2749
THE DIFFERENTIAL EQUATION OF A UNIPOLAR CORONA AND ITS INTEGRATION IN THE SIMPLEST CASES. N. N. Tikhodeev. Translated from Zhur. Tekh. Fiz. 25, 1449-57(1955).

An analysis of the three simplest cases of unipolar corona made it possible to establish a number of properties of the corona discharge. It should be noted that, firstly, in all three cases there is a much more complicated dependence of the corona current on voltage than was assumed in earlier papers and, secondly, the dependence of the corona current on the interelectrode gap varies (for plane electrodes the current density is inversely proportional to the cube of the interelectrode gap; for cylinders the current per unit cylinder length is inversely proportional to the square of the radius of the outside electrode; and for spheres the current is inversely proportional to the radius of the inside sphere). A comparison of the derived current-voltage characteristic for concentric cylinders with the extensive experimental data in the literature showed good agreement. This provides a basis for believing that the assumptions involved in the deduction of the equation and in its solution correspond, in first approximation, to the physical picture both in the case of one-dimensional and two-dimensional problems. (auth)

8057 AEC-tr-2751
ELECTROACOUSTIC WAVES IN A GAS DISCHARGE PLASMA AND SPACE RECOMBINATION. M. V. Konyukov and Ya. P. Terletskii (Terletsky). Translated from Zhur. Eksptl.' i Teoret. 29, 874-6(1955). 4p.

The role of space recombination in problems concerning the behavior of electroacoustic waves in a gas discharge plasma is briefly discussed. (B.J.H.)

8058 AEC-tr-2755
THE MODERN STATE OF THE THEORY OF ELECTRICAL BREAKDOWN OF SOLID DIELECTRICS. V. (B.) A. Chuenkov. Translated from Uspekhi Fiz. Nauk 54, 186-230(1954). 36p.

Modern knowledge concerning the phenomenon of electrical breakdown shows that the existing theories can be subdivided into two groups: 1) theories dealing with the disruption of the dielectric strength, 2) theories dealing with the mechanical destruction of the dielectric. Neither group of theories gives a full description of the entire picture of the development of breakdown: the disruption of the dielectric strength is the initial stage of electrical breakdown, and the destruction of the material completes the breakdown process. At the present time the theory of the first stage of electrical breakdown—loss of dielectric strength—has been developed in the most detail. There is reason to believe that the most correct approach to the development of the theory of the disruption of dielectric strength is the one involving the statement of the problem in the form of the kinetic equation for the electrons in a solid body. Due to a number of difficulties which arise when such a program of theoretical investigation is pursued with regard to breakdown (the impossibility of making use of the usual approximate methods of computation when $\epsilon \lesssim \hbar\omega_{deb}$, the absence of data on the effective ionization cross sections and recombination cross sections in solid dielectrics, etc.), modern theory is based upon a large number of assumptions which are not always fully sound. The most immediate problems within reach of the theory are the following: the computation of the effective ionization cross section in a solid body for the case where the ionizing electron has small energies ($\epsilon \gtrsim I$), the computation of the probability of slow electrons ($\epsilon \sim \hbar\omega_{deb}$) being scattered by lattice vibrations, and the computation of the effective recombination cross section. Therefore, the further development of the theory of electrical breakdown requires the solution of a number of general problems involved in the theory of solid bodies. The theory of the second stage of electrical breakdown has hardly been developed at all. The destruction of the dielectric during breakdown is examined, as a rule, separately from the first stage and is not associated with the conditions governing the passage of an avalanche through a solid body. Such an approach seems incorrect to us, since it ignores a qualitative feature of a dielectric in breakdown fields—its rapid transition into a highly conducting state which is accompanied by the evolution of large amounts of energy in small volumes during short periods. It may well be that the true cause of the destruction of the dielectric is associated precisely with these processes which lead to the origination of an impact wave (this is analogous to what happens when gases that are under large pressures are

broken down). Therefore, a fruitful approach to the theory is the examination of the processes involved in the destruction of the dielectric from the point of view that these processes are inseparable from the preceding processes which are involved in loss of dielectric strength. (auth)

8059 AEC-tr-2756

METHOD FOR CLEANING GLASS AND METAL SURFACES BY MEANS OF A GAS DISCHARGE. V. V. Karasev and G. I. Izmailova. Translated from Zhur. Tekh. Fiz. 24, 871-4(1954). 5p.

Diagrams are given of a gas discharge apparatus which was successfully used to clean glass and metal surfaces to a high degree of purity. Data concerning the performance of the apparatus are included. (B.J.H.)

8060 AEC-tr-2758

OSCILLATIONS IN GAS-DISCHARGE DEVICES. M. M. Chetverikova. Translated from Elektrichestvo, No. 2, 16-20(1951). 7p.

The basic results obtained in a study of high-frequency oscillations in both special gas-discharge tubes, especially developed for this purpose, and commercial thyratrons and gas-rectifiers is presented. The oscillations were studied with and without an external tuned loop connected to the circuit. Oscilloscope pictures illustrating these oscillations are presented. (auth)

8061

STABILITY OF PLASMAS CONFINED BY MAGNETIC FIELDS. M. N. Rosenbluth and C. L. Longmire (Los Alamos Scientific Lab., N. Mex.). Annals of Physics 1, 120-40(1957) May.

The stability of plasmas confined by magnetic fields is examined. Whereas previous studies of this problem have started from the magnetohydrodynamic equations, closer attention is given here to the motions of individual particles. Results are similar to, but more general than, those which follow from the magnetohydrodynamic equations. (auth)

8062

RESONANCE METHOD OF DETERMINATION OF ELECTRON CONCENTRATIONS AND THE NUMBER OF COLLISIONS IN GAS DISCHARGE PLASMA. I. I. Vasserman. Zhur. Tekh. Fiz. 27, 516-21(1957) Mar. (In Russian)

A new method was used in studies of plasma of various gases with a wide range of electron concentrations and wave length. A discharge tube was placed between the plates of a flat condenser which was switched into the Thomson contour. Resonance curves developed from the cold and hot tube allowed mean values for n and ν to be determined. Results of studies of plasma in mercury vapor at 10^{-3} mm Hg in a high-frequency field of 20 Mc are given. (R.V.J.)

8063

IMPULSE DISCHARGE IN ARGON AT SUPER HIGH FREQUENCIES. 1. ELECTRON DISTRIBUTION FUNCTION BY VELOCITIES. V. E. Golant. Zhur. Tekh. Fiz. 27, 756-70(1957) Apr. (In Russian)

The electron distribution function by velocities corresponding to the impulse discharge in argon at super high frequencies with a pulse order of 10^{-6} sec has been determined. Calculations were based on analytical approximations for elastic and inelastic argon electron-atom collisions. The distribution function was applied in calculations of the coefficient of electron ionization of argon atoms and of the argon high frequency conductivity in the initial development of impulse discharge. Calculations were also made for the coefficient of electron capture by water molecules with small additions of water vapor to argon. (R.V.J.)

8064

HIGH FREQUENCY IMPULSE DISCHARGE IN ARGON. II. DISCHARGE ORIGINATED BY SQUARE-TOPPED PULSE. V. E. Golant. Zhur. Tech. Fiz. 27, 771-83(1957) Apr. (In Russian)

The critical amplitude of electric field intensity was calculated to determine the discharge in argon originated by a high-frequency square-topped pulse. The calculations were made for single and periodically repeating high-frequency impulses. The calculated data were correlated with the results of experimental studies of the impulse discharge originating in argon at 2800 Mc frequency. (R.V.J.)

ELECTRONS

8065

NUMERICAL K-ELECTRON FUNCTIONS FOR DETERMINING THE PROBABILITIES OF ALLOWED AND FORBIDDEN K CAPTURE. I. M. Band, L. N. Zyryanova, and Tsin Chen-Zhuĭ (Leningrad Zhdanov State Univ., Research Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1387-98(1956) Dec. (In Russian)

Numerical values for coefficients of captured electron wave functions were found with corrections for the finite nuclear dimensions and screening of the K electron wave functions. (R.V.J.)

8066

THE USE OF ELECTRON BEAMS IN INDUSTRIAL PROCESSES. E. Dale Trout. Radiology 68, 708-13(1957) May.

The history of non-medical uses of electron beams and current industrial applications of electron beams are reviewed. Some future possibilities are pointed out. (C.H.)

8067

EFFECTS OF REFLECTED ELECTRONS ON SECONDARY ELECTRON EMISSION. L. N. Dobretsor and T. L. Matskevich (Leningrad Inst. of Physics in Technology). Zhur. Tekh. Fiz. 27, 734-44(1957) Apr. (In Russian)

Evaluations of the effects of reflected electrons on the excitation of secondary electron emissions are reported. A new scheme developed for measuring the σ_{theor} by a single-pulse method improved the order of accuracy 1 to 2%. Coefficients of secondary electron emissions σ_{meas} and σ_{theor} measured for NaCl, NaBr, NaI, NaF, LiF, SiO_2, Ca_2CO_3, and mica showed that the law of similarity cannot be applied for these dielectrics. Measurements of angular dependence of σ_{theor} and σ_{meas} revealed that σ_{sec} in some dielectric in the area of $U_p < U_p$ max decreases with increase of the angle of incidence, which could be related to the growth of the reflection coefficient with the increase of ϕ. Formulas for σ_{theor} were developed with the experimental data for the U_p area where the mean free path of primary electron scattering is longer than the practical wave length of secondary electron λ_2. (R.V.J.)

GASES

8068

SHOCK COMPRESSION OF A PERFECT GAS. Cerda Evans and Foster Evans (Los Alamos Scientific Lab., N. Mex.). J. Fluid Mechanics 1, Part 4, 399-408(1956) Oct.

The compression of a perfect gas between a uniformly moving piston and a rigid wall is discussed in the one-dimensional case. If the piston moves with a finite speed, it will initiate a shock in the gas which will reflect successively from rigid wall and piston and cause the compression process to deviate from a reversible adiabatic process. Expressions are derived for the relative changes

in pressure and density at each shock reflection. Then values of density and pressure after any number of shock reflections are computed relative to their initial values, and, in terms of these, the corresponding values of temperature and entropy, as well as shock speeds, are determined. The limiting value of the entropy change, as the number of reflections goes to infinity, is obtained as a function of the ratio of specific heats of the gas and the strength of the initial shock. Hence it is possible to estimate an upper limit to the deviation of the shock compression process from a reversible adiabatic process. Some illustrative numerical examples are given. (auth)

INSTRUMENTS

8069 AECU-3465
Sandia Corp., Albuquerque, N. Mex.
REMOTE-OPERATED MULTIPLE OSCILLOSCOPE AND CAMERA PROGRAMMER. John A. Price, Paul L. Kerley, and Vaughn D. Nogle. Mar. 8, 1957. 5p. Contract [AT(29-1)-789]. (TM-50-57-14). $1.80(ph OTS); $1.80(mf OTS).

The remote-operated oscilloscope and camera programmer was developed to allow the remote operation of up to four oscilloscopes and associated equipment for the purpose of recording simultaneously, with oscilloscope cameras, information from a unit being tested. (auth)

8070 AECU-3466
Sandia Corp., Albuquerque, N. Mex.
VARIABLE TIME BLANKING MARKER. Paul L. Kerley and Vaughn D. Nogle. Feb. 28, 1957. 7p. Contract [AT(29-1)-789]. (TM-51-57-14). $1.80(ph OTS); $1.80 (mf OTS).

A system is described which permits the use of variable time reference marks on the traces of CRT oscilloscopes where two or more scopes must be used simultaneously. Sweep blanking is used since it causes less interference with the desired waveform presentation. The blanking pulse is applied to the CRT cathode and is variable in width as well as being variable with respect to sweep start time. (auth)

8071 AECU-3479
Sandia Corp., Albuquerque, N. Mex.
APPLICATIONS OF AN OSCILLATING CAPACITOR. K. E. Pope and T. H. Martin. May 14, 1957. 17p. Contract AT(29-1)-789. (TM-112-57-14). $3.30(ph OTS); $2.40(mf OTS).

A simple new device is described which consists of a capacitor on a rotating shaft which is commutated between a large capacitor and a voltage source or between a charged larger capacitor and a short. Two applications, a counter and a function generator, are described. The equations governing the circuit action shown in the memo have been derived and checked in the laboratory. (auth)

8072 AECU-3490
Sandia Corp., Albuquerque, N. Mex.
USE OF SANDIA CORPORATION ANALOG COMPUTER IN SLED DESIGN. F. J. Maloney. Jan. 18, 1957. 23p. Contract [AT(29-1)-789]. (TM-267-56-21). $4.80(ph OTS); $2.70(mf OTS).

Formulas were developed on an analog computer for the rocket thrust, the inertia forces (which are continually changing because of decreasing rocket propellant weight), aerodynamic drag, and rail friction for a sled designed to reach a velocity of 1600 ft/sec without exceeding 6 g's of acceleration or deceleration, and for a single-stage sled designed to reach 3000 ft/sec in shortest possible distance. Data and formulas are presented for the case when the sled is stopped by a water brake. The design of the water brake is similar to the one used at the NOTS track in Inyokern. A typical solution of a three-stage sled is given in graphical form. (R.V.J.)

8073 AECU-3493
Sandia Corp., Albuquerque, N. Mex.
PASSIVE DIGITAL TRANSLATOR DESIGN. G. R. Bussey. May 15, 1957. 10p. Contract AT(29-1)-789. (TM-91-57-14). $1.80(ph OTS); $1.80(mf OTS).

A practical technique for the logical design of digital translators is described which minimizes the required hardware. Direct-coupled transistor logic is employed in illustration of the method. (auth)

8074 AECU-3495
Sandia Corp., Albuquerque, N. Mex.
AN ANALOG FALLOUT COMPUTER. H. B. Durham. Nov. 2, 1956. 11p. Contract AT(29-1)-789. (TM-207-56-14). $1.80(ph OTS); $1.80(mf OTS).

A brief description is given of an analog computer based on a LASL fall-out model. The scheme of the fall-out model is included and some thoughts are offered for the improvement of the computer. (auth)

8075 NP-6313
National Research Council. Committee on Nuclear Science.
MULTICHANNEL PULSE HEIGHT ANALYZERS. Proceedings of an Informal Conference, Gatlinburg, Tennessee, September 26-28, 1956. Publication No. 467. H. W. Koch and R. W. Johnston, eds. 1957. 216p.

Its Nuclear Science Series, Report No. 20.

Discussions included reviews of pulse height analysis problems, detectors, and pulse shaping. The developments in different countries were described. Other topics discussed were on computer techniques, calibration, XYZ recording, and future trends. (M.H.R.)

8076 WADC-TR-56-178
Radiation, Inc., Melbourne, Fla. and Wright Air Development Center. Aero Medical Lab., Wright-Patterson AFB, Ohio.
SURVEY OF LOW LEVEL MODULATORS. John H. Searcy and Ralph A. Johnson. Feb. 1956. 86p. Project title: SURVEY OF LOW LEVEL MODULATORS. Contract AF33(616)-2985. (AD-99657).

A survey of commercially available and developmental low-level modulators is made. Fundamental limitations which restrict the minimal signal are the prime requisites for evaluation. Consideration is also given to transfer linearity, complexity, size, weight, and power requirements. (auth)

MASS SPECTROGRAPHY

8077
CONTINUOUS SCANNING IN TWO DIRECTIONS OF THE ION BEAM IN AN ELECTROMAGNETIC ISOTOPE SEPARATOR. K. O. Nielsen and O. Skilbreid (Univ. of Copenhagen). Nuclear Instr. 1, 159-65(1957) May.

A system is described for continuous supervision of the shape and position of the image in the focussing plane of an electromagnetic isotope separator. Two thin needles —one horizontal and one vertical—are moved through the fixed beam. In this way a picture of the extension of the beam in both directions is obtained on an oscilloscope screen. Since even small changes in the shape of the beam can be observed, it is possible to maintain the focussing condition at maximum resolving power, and thereby to increase the effective separation power. The amplitude of the needle oscillation can be adjusted so that the whole mass spectrum of any element, except hydrogen, is covered. (auth)

8078
CALCULATIONS OF THE RESOLVING POWER AND CYCLE SELECTIONS FOR THE TRIPLE-STAGE RADIO-FREQUENCY MASS SPECTROMETER. M. Ya. Shcherbakova. (Novosibirsk Inst. of Mining and Geology). Zhur. Tekh. Fiz. 27, 599-605(1957) Mar. (In Russian)

The ion beam energy increase in passing through the modulating grid of the analyzer was determined, and the formula for the resolving power of the apparatus was developed. Optimal cycles for the first and second space drifts were selected. (R.V.J.)

MATHEMATICS

8079 AECU-3485
Sandia Corp., Albuquerque, N. Mex.
CONFIDENCE INTERVALS FOR THE STANDARD DEVIATION OF A NORMAL POPULATION. G. P. Steck, D. B. Owen, and J. M. Wiesen. Jan. 15, 1957. 61p. Contract [AT(29-1)-789]. (TM-241-56-51). $10.80(ph OTS); $3.90(mf OTS).

The properties of the different types of confidence intervals that can be used to estimate the standard deviation of a normal distribution are described. Methods for determining the sample sizes in such estimation procedures are discussed, and graphs are provided for the application of such methods. (auth)

8080 IDO-16362
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
COMPUTER PROGRAM FOR CALCULATING TOTAL CROSS SECTION FROM CRYSTAL SPECTROMETER DATA. R. S. Marsden. Sept. 10, 1956. 12p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

A program has been set up to process the MTR crystal spectrometer data on the IBM type 650 computer. These data are essentially of the form described in IDO-16168. For use with the computer these data are punched on IBM cards in addition to being typed. This program computes the total cross section and the energy at which the cross section was measured. The results of the computation and identifying information are punched out on cards at the rate of about one every three seconds. Approximately ten minutes are required to set up the computer for the program. Tests have been included to stop the program if the data cards are not in the correct order. The program can handle any number of samples up to five with one open position anywhere in the sequence of samples. (auth)

8081 KAPL-1724
Knolls Atomic Power Lab., Schenectady, N. Y.
CURE: A GENERALIZED TWO-SPACE-DIMENSION MULTIGROUP CODING FOR THE IBM-704. E. L. Wachspress. Apr. 30, 1957. 132p. Contract W-31-109-Eng-52. $0.65(OTS).

A detailed description of a generalized two-space-dimension multigroup calculation for the IBM-704 is given. Basic theory, input and output format, a guide to the flow-charts, tape movements, and operational procedure are included in the discussion. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

8082 DP-190
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A LIQUID SCINTILLATOR FOR THE ANALYSIS OF TRITIUM IN WATER. Frank E. Kinard. Dec. 1956. 12p. Contract AT(07-2)-1. $0.15(OTS).

A new liquid scintillator recipe was developed for use with samples of tritiated water. The mixture will dissolve twice as much water as the most widely used formula and, in addition, has a 50% higher scintillation efficiency. The new recipe is made up of 5 parts xylene, 5 parts 1,4-dioxane and 3 parts ethanol, to which have been added 80 g/l naphthalene, 5 g/l 2,5-diphenyloxazole and 0.05 g/l α-naphthylphenyloxazole. One hundred cc of this mixture will dissolve 7.7 cc of water. (auth)

8083
IMPROVED RADIATION INSTRUMENT FOR SIMPLIFIED DETERMINATIONS OF BLOOD VOLUME WITH ISOTOPES. Edmund A. Smolik, Wilfred Konneker, Francis P. Nash, and Raymond O. Muether (St. Louis Univ. School of Medicine, Mo., Neurosurgical Services of City, County, St. Louis, Mo., and DePaul Hospitals, St. Louis, Mo.). Am. J. Clin. Pathol. 26, 1133-6(1956) Oct.

8084
LOW-TEMPERATURE ISOTHERMAL TREATMENT OF THICK NUCLEAR PLATES. Georges Marguin. Compt. rend. 244, 2304-6(1957) Apr. 29. (In French)

This new method, which uniformly developes the minimum ionization tracks of nuclear particles at a constant temperature of 5°C, is based on a progressive variation of the pH of the baths. The emulsions conserve their initial dimensions and have a negligible distortion and a good transparency. (tr-auth)

8085
ON THE CHOICE OF THE PARAMETER MOST SENSITIVE TO THE VARIATION OF PARTICLE SPEED IN THE NUCLEAR EMULSION. Tsai-Chu and Jacqueline Claret. Compt. rend. 244, 2381-3(1957) May 6. (In French)

For a measurement of ionization, the most sensitive parameters are respectively: at the end of the range, the total length of the gaps, and at minimum ionization, the total length of the grains, which have there a relative variation greater than that of the other characteristics. The measurement of the integral length of the gaps allows discrimination between protons and π mesons having a very small residual range. (tr-auth)

8086
STUDIES OF DOUBLE-LENS β SPECTROMETER AND THE IMPROVEMENT OF ANNULAR FOCUSING. Ya I. Gaziev, K. P. Mitrofanov, and V. S. Shpinel (Moscow, Lomonosov State Univ., 2nd Research Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1407-16(1956) Dec. (In Russian)

Experimental investigations were made of double-lens β-spectrometer focusing properties and of the annular focusing improvement achieved by internal correcting coil. The construction scheme, electron trajectories, and the effects of the internal coil are shown (R.V.J.)

8087
MEASUREMENTS OF γ-γ COINCIDENCES IN Ir^{192} AND Sb^{124} SPECTRA. L. L. Pelekis (Inst. of Physics, Acad. of Sciences Latvian S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1419-22(1956) Dec. (In Russian)

Measurements of γ-γ coincidences were taken with two scintillation spectrometers with single-channel coincidence analyzers, and resolving time of 1×10^{-6} sec. Crystals of NaI(Tl) and CsI(Tl) with MgO reflector were used for the experiment. The area of strong γ spectral intensities obtained for Ir^{192} is shown. The coincidence spectra for Ir^{192} was observed in γ-spectra correlations with γ rays of 0.310, 0.470, and 0.605 Mev and γ-spectra correlation with x rays of 65 kev; x rays were absorbed by Cd(1mm) and Cu(0.5mm) screen. Measurements for Sb^{124} γ-γ coincidence spectra were taken under similar conditions, correlations being observed with γ rays of energies of ~ 0.6, 1.7, and 2.1 Mev, respectively. The width of the stationary channel "window" was 160 kev. (R.V.J.)

8088

COMBINATION β-γ SPECTROMETER. M. P. Glazunov and V. I. Spitsyn (Inst. of Chemical Physics, Acad. of Sciences U.S.S.R.). Izvest Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1423-9 (1956) Dec.

A new combination β-γ spectrometer combining the features of a β spectrometer of the ketron type and a γ spectrometer of the elotron type has been developed. The scheme, construction, and efficiency of the spectrometer are described. (R.V.J.)

8089

DOUBLE-CRYSTAL LUMINESCENCE TYPE γ SPECTROMETER. E. L. Stolyarova and I. E. Konstantinov (Moscow Inst. of Engineering Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1430-3(1956) Dec. (In Russian)

The resolving efficiency and performance of the spectrometer were studied using electron recoil spectra from monochromatic γ rays of Hg^{203}, Cs^{137}, and Co^{60}. (R.V.J.)

8090

UTILIZATION OF IONIZATION CHAMBERS FOR THE α-γ-ANGULAR CORRELATIONS. Yu. I. Filimonov and G. A. Petrov. (Leningrad Inst. of Physics in Technology, Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1434-7(1956) Dec. (In Russian)

Descriptions are given for an effective utilization of ionization grid chambers in recording the directions of α-particle emissions. Investigations of α-γ-angular correlation on ThC'' were used to check the effectiveness of the offered scheme. (R.V.J)

8091

UTILIZATION OF PULSE IONIZATION CHAMBERS AS α SPECTROMETERS. THE DESIGN AND OPERATION OF THE CHAMBER. B. A. Bochagov, A. A. Vorob'ev, and A. P. Komar. (Leningrad Inst. of Physics in Technology, Acad. of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1455-60(1956) Dec. (In Russian)

8092

A TRANSISTORIZED RADIATION MONITOR. D. C. Brown and B. P. Faraday (Coll. of Aeronautics Department of Aircraft Electrical Engineering). Nuclear Instr. 1, 133-7 (1957) May.

The investigation of a number of possible semiconductor devices which can be used for the detection of radioactive particles is described. The sensitivities of two types of transistor (a p-n-p alloy junction and an n-p-n grown junction) and a p-n alloy junction diode operated up to its ''avalanche'' condition were determined. The possible uses of such detectors are discussed and they are shown to be particularly suitable where high rates of counting, with good efficiency and small detecting area (or low geometry) are required. A completely transistorized radiation monitor has been developed using a p-n-p transistor as the detector head. This is specifically designed for α-particle detection but the detector head with slight modification should be suitable for proton or neutron detection. (auth)

8093

THE LOADING OF NUCLEAR EMULSIONS WITH WATER. C. J. Batty (Univ. of Birmingham, Eng.). Nuclear Instr. 1, 138-42(1957) May.

The rate of absorption of water by G5 emulsions has been studied at temperatures between 6 and 18°C, and the relation between swelling and water content determined. The volume of the swollen emulsion is generally less than the sum of the volumes of water and dry emulsion, and this can affect cross-section measurements. The grain density of 540 Mev proton tracks falls by about a third when 3 g of water is absorbed in 1 cm^3 of dry emulsion. An area scan for p-p elastic collisions gives, as expected, a reduced ratio of background events in the loaded emulsion. (auth)

8094

SCINTILLATION SPECTROMETER WITH CONSTANT RELATIVE CHANNEL WIDTH. Björn Aström (Nobel Inst. of Physics, Stockholm). Nuclear Instr. 1, 143-7 (1957) May.

It is shown that many of the difficulties involved in making automatic recordings of the γ spectra measured with a scintillation spectrometer can be eliminated by using a pulse amplitude discriminator with a varying channel width. The circuit of such a discriminator is given. It is also shown how γ-intensity ratios can be evaluated from different types of measurements. (auth)

8095

ELIMINATION OF END EFFECTS IN PROPORTIONAL COUNTERS. C. P. Sikkema. Nuclear Instr. 1, 148-51 (1957) May.

The method for eliminating end effects in proportional counters has been extended to much smaller wire thicknesses, thus making it suitable for most practical applications. The technique developed for the wire construction is described in detail. (auth)

8096

A γ-RAY COLLIMATOR AND EXPANSION CHAMBER FOR USE WITH THE 340 Mev ELECTRON SYNCHROTRON. J. R. Atkinson, W. McFarlane, J. M. Reid, and P. Swinbank (Univ., Glasgow). Nuclear Instr. 1, 152-8 (1957) May.

A collimator and Wilson type expansion chamber used at Glasgow University for the study of nuclear photodisintegration is described. The collimated beam has a diameter of 2.0 cm in the beam room, 6 meters from the machine target. The beam room is shielded against background radiation from the machine by a lead and concrete screen. The cloud chamber control system is very flexible and allows chamber and machine operations to be accurately synchronized. (auth)

8097

DELAYED-NEUTRON MONITORS FOR THE DETECTION OF SHEATH FAILURES IN REACTOR FUEL RODS. C. H. Millar, B. W. Sargent, and J. C. Horsman (Atomic Energy of Canada Ltd, Chalk River, Ontario). Nuclear Sci. and Eng. 2, 363-72(1957) May.

Development is described of a device to detect holes in the fuel-rod sheaths in an H_2O-cooled heterogeneous reactor by detecting delayed neutrons from fission products in the effluent coolant. Operational comparison with other types of monitors is tabulated for 22 cases of burst rod sheaths. Modifications required to adapt the monitor to a D_2O-cooled reactor are discussed. (auth)

8098

COMPARISON OF CdS (MONOCRYSTAL) AND CdS (POLYCRYSTAL) PHOTORESISTANCE IN THE X-RAY REGION. S. V. Svernikov (Kiev Order of Lenin Polytechnic Inst.). Zhur. Tekh. Fiz. 27, 656-62(1957) Apr. (In Russian)

Dosimetric properties of CdS monocrystals and CdS compressed powder polycrystals in x radiation are evaluated. (R.V.J.)

8099

HIGH-PRESSURE CLOUD CHAMBER PHASED WITH SYNCHROTRON. I. P. Yavor and A. P. Komar (Leningrad Inst. of Physics in Technology). Zhur. Tekh. Fiz. 27, 868-74(1957) Apr. (In Russian)

Descriptions are given of a high-pressure cloud chamber performing on a cycle of 10 to 15 sec. The control scheme and phasing of the chamber with a synchrotron at 100 Mev are described. (tr-auth)

MESONS

8100
PHOTOPRODUCTIONS OF π^0 MESONS ON COMPLEX NUCLEI. A. S. Belousov, E. I. Tamm, and E. V. Shitov. Doklady Akad. Nauk S.S.S.R. 112, 1017-19(1957) Feb. 21. (In Russian)

Photoproduction of π^0 mesons on nuclei at various γ-ray energies was studied to determine if meson production takes place only on the surface or on the total nuclear volume. The γ quanta of π^0-meson decay were registered by a scintillation counter place at 90° to the synchrotron beam. The relations between π^0 meson yield and the atomic number were evaluated for E_γ^m, the maximum energy of bremsstrahlung beam, from Li, C, Al, Cu, Cd, and Pb targets. Results show that the relations of the cross sections of π^0-meson production on nuclei to the atomic number remain unaltered at E_γ^m equal to 310, 265, and 200 Mev although, the maximum of π^0 meson energy spectra shifts from 100 to 20 Mev. The latter condition can be caused by the presence of another competing process which depresses the formation of mesons inside of nuclei and leads to meson production on the surface. (R.V.J.)

8101
A DECAY OF A NEGATIVE τ'. S. Nilsson (Inst. of Physics, Uppsala, Sweden). Nuclear Phys. 3, 364-6(1957) May.

An event, which is consistent with the decay in flight of a negative τ', $\tau' \rightarrow \pi^- + \pi^0 + \pi^0$, has been found. It is concluded that the negative K- meson decay modes so far observed include the $K^-_{\pi 2}$, K^-_{e3}, τ^-, and the negative τ'. (M.H.R.)

8102
SOME REMARKS ON DECAY RATES OF HEAVY MESONS. B. D'Espagnat, R. Omnes, and J. Prentki (CERN, Geneva). Nuclear Phys. 3, 471-5(1957) May.

The lifetimes of particles and their antiparticles are discussed under different assumptions. It is shown that if P·C is conserved these lifetimes are rigorously equal, but in practice their equality is no evidence for P·C conservation even when strong final state interactions do exist. The P·C conservation is best tested by the K^0 modes of decay. A description of $K\mu\nu$ interaction by means of a direct coupling only (Yukawa type) is shown to be impossible. (auth)

8103
INTERFERENCE PHENOMENA OF K^+-MESON SCATTERING BY NUCLEI. D. Fournet Davis (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 816-17(1957) May 15.

An analysis of the elastic scatters of K^+ mesons in emulsion shows that the data favor a repulsive nuclear potential. A description of the analysis of the experimental results is given. (auth)

8104
EVIDENCE AGAINST SPIN 1 FOR THE τ MESON. J. Orear (Columbia Univ., New York). Phys. Rev. 106, 834-5(1957) May 15.

An analysis of data on τ mesons leads to the conclusion that a spin of 1 or any odd value for the τ meson is unlikely. Spins of 0 and 2 are both consistent with the data. (B.J.H.)

8105
ENERGY DEPENDENCE OF THE ASYMMETRY IN THE BETA DECAY OF POLARIZED MUONS. D. Berley, T. Coffin, R. L. Garwin, L. M. Lederman, and M. Weinrich (Columbia Univ., New York). Phys. Rev. 106, 835-7(1957) May 15.

Further results are presented on the energy dependence of the asymmetry in the β decay of polarized mesons. This energy dependence is deduced from measurements of the asymmetry as a function of positron range in carbon. Comparison is also made with the predictions of the two-component neutrino theory. (B.J.H.)

8106
K-MESON DECAYS THROUGH A FERMI INTERACTION. J. C. Polkinghorne, D. L. Pursey, and H. A. Santa Maria (Univ. of Edinburgh). Proc. Phys. Soc. (London) A70, 321-3(1957) May.

The decay of K mesons by means of a weak Fermi interaction is investigated. For the decay of the θ^+ into π^+ and π^0, only $\Delta I = 3/2$ contributes. It is shown that if the only hyperon taking part is Λ then the interaction must be S-A-P for pure $\Delta I = 3/2$. The case in which other hyperons participate is considered. For a Σ-nucleon interaction it is necessary to have S-A-P for pure $\Delta I = 5/2$. Some other less specific results are also obtained. (auth)

8107
PI MESODYNAMICS. F. E. Low (Massachusetts Inst. of Tech., Cambridge). Revs. Mod. Phys. 29, 216-22(1957) Apr.

The various hypotheses concerning low-energy pi mesons are discussed in relation to the real mesonic phenomena that take place at low energies, meson-nucleon scattering and photoproduction of mesons. (M.H.R.)

8108
PRESENT KNOWLEDGE ABOUT THE NEW PARTICLES. C.N. Yang (Inst. for Advanced Study, Princeton, N. J.). Revs. Mod. Phys. 29, 231-5(1957) Apr.

The present knowledge about mesons and hyperons is discussed. Discussions of various theoretical problems of current interest, especially the question of the identity of the K particles, are included. (M.H.R.)

MOLECULAR PROPERTIES

8109
MOLECULAR BEAMS. R. Schnurmann (Manchester Oil Refinery Ltd., Eng.). Research (London) 10, 185-97(1957) May.

The development, techniques, and applications of molecular beams are discussed. The particular emphasis is on beam techniques with discussions included on sources, detectors, magnetic deflection fields, and experimental methods. Schematic diagrams and other illustrations are included. (M.H.R.)

NEUTRONS

8110
THE NEUTRON VELOCITY SPECTRUM IN A HEAVY MODERATOR. E. Richard Cohen (Atomics International, Canoga Park, Calif.). Nuclear Sci. and Eng. 2, 227-45 (1957) May.

The differential equation developed by Wilkins to represent the velocity spectrum of neutrons in a heavy moderator is investigated for the case of 1/v absorption. An exact solution to terms of second order in the absorption parameter allows an accurate determination of the asymptotic neutron density. For large absorption parameters a numerical integration can yield higher accuracy. The analytic solution is applied to the calculation of the total migration area of neutrons from a monoenergetic source. (auth)

8111
MEASURING THE RATIO OF THERMAL TO RESONANCE NEUTRON DENSITIES USING THICK INDIUM FOILS. Moses A. Greenfield (Univ. of California at Los Angeles)

and Roscoe L. Koontz and Alan A. Jarrett (Atomics International, Canoga Park, Calif.). Nuclear Sci. and Eng. 2, 246-52(1957) May.

Measurements have been made of the cadmium ratios of indium foils for thicknesses ranging from 0.012 mg/cm^2 to approximately 100 mg/cm^2. Correction factors are presented both graphically and in tabular form to determine the ratio of thermal to resonance neutron densities from measurements made with an indium foil of any thickness up to 100 mg/cm^2. (auth)

8112

THE WIGNER-WILKINS CALCULATED THERMAL NEUTRON SPECTRA COMPARED WITH MEASUREMENTS IN A WATER MODERATOR. Harvey J. Amster (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, 394-404(1957) May.

The calculational advantages of the Wigner-Wilkins thermal flux spectra make it a desirable theory to use for the determination of thermal group constants in water-moderated reactor systems; however, the physical assumptions required by the theory are far from satisfied by water, and an experimental verification of the theory is called for. Such data have been furnished by M. J. Poole at Harwell. Comparisons with calculations from the theory of Wigner and Wilkins show surprisingly good agreement, although some consistent deviations are noted. (auth)

8113

POLARIZED NEUTRON BEAMS. G. H. Stafford, S. Tornabene, and C Whitehead (Atomic Energy Research Establishment, Harwell, Didcot, Berkshire, Eng.). Phys. Rev. 106, 831-2(1957) May 15.

The production of polarized neutron beams is briefly reviewed. (B.J.H.)

8114

DETECTION OF NEUTRINO. L. D. Puzikov (Moscow Inst. of Physics in Technology). Priroda, 46, 83-5(1957) Mar. (In Russian)

Descriptions are given of Raines and Cowen experiments in capturing the neutrino. (R.V.J.)

8115

EFFECTIVE BOUNDARY CONDITIONS ON THE BOUNDARY OF MULTIPLYING AND MODERATING MEDIUMS. A. Akhiezer, N. Akhiezer, and G. Lubarskiĭ (Kharkov Physico-Technical Inst.). Zhur. Tekh. Fiz. 27, 822-9 (1957) Apr. (In Russian)

Effective boundary conditions for thermal neutrons on the interface boundary line of multiplying and moderating media have been found for the cases where slowing down properties of both media are identical. (tr-auth)

NUCLEAR PHYSICS

8116 HW-48893

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1956. Mar. 6, 1957. 102p. Contract W-31-109-Eng-52. $0.55(OTS).

Measurements of $(k_\infty - 1)$ in the PCTR as a function of the gold-cadmium ratio were found to exhibit a minimum. A technique was found for determining the proper value of $(k_\infty - 1)$ from these measurements. A theoretical explanation of these results was developed. Exponential measurements were made on water-moderated and graphite-moderated lattices containing enriched uranium rods. The effect of temperature on the buckling of a graphite-moderated lattice was determined experimentally. A theoretical study was made of the energy expended in electronic collisions. (auth)

8117 ISC-833

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN PHYSICS FOR JULY THROUGH DECEMBER 1956. Mar. 13, 1957. 40p. Contract W-7405-eng-82. $0.30(OTS).

Theoretical discussions are included on beta decay of P^{32}, radiative π-e decay, photodecay of neutral pions, and the mass differences of the Σ hyperons. Experimental studies on the time-jitter adapter for single-channel pulse height analyzers, an electrostatic analyzer for proton energies below 300 kev, the extraction of electrons from a conventional synchrotron, and a proportional counter spectrometer are discussed. The experimental work on the fission fragment ionization yield in argon, helium, and helium + argon has been completed and results are tabulated. Single crystals of Mg_2Si and Mg_2Ge were grown and one sample found to be 100 times purer than any previously reported. The resistivities and Hall coefficients of these crystals at 300°K are compared with those of other investigators. The temperature dependences of the resistivities, Hall coefficients and Hall mobilities are shown. The energy gap is determined by various methods and the results compared. A new method of preparing single crystals of tungsten oxide using high-pressure tungsten oxide vapor is described. Thermal diffusivity and electrical resistivity of high-purity iron and modifications in the pulse method for specific heat measurements are discussed. A mass spectrometric method of studying the thermodynamic properties, of metals at high temperatures have been carried out on dysprosium, erbium, holmium, terbium, lutetium, and gadolinium, and the results are given. Other studies are included on charge trappings in a diamond conduction counter, magnetic measurements on single crystals of neodymium and dysprosium, superconductivity of lanthanum and lanthanum-rich alloys, and nuclear quadrupole resonance spectra of group III B trihalides. (For preceding period see ISC-758.) (M.H.R.)

8118

α-γ ANGULAR CORRELATION OF ThC″(Tl^{208}). V. A. Korolev, L. A. Kul'chitskiĭ and A. I. Zhernovoĭ. (Leningrad Inst. of Physics in Technology, Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1451-4(1956) Dec. (In Russian)

Studies were made of α-γ angular correlation of ThC″ in transitions to second and fourth excitation levels. Transition intensities at these levels were 1.8 and 1.1%. The small transition intensities and the great number of γ lines in the spectrum of the active thorium precipitation source from ThB, ThC′, and ThD complicated the measurements of the angular correlation and required methods of measurements with a good separation of α particles and γ-quanta lines. Results of measurements showed that for the ThC″ normal state moment the value 1^+ should be selected. The value 3^+ is the more probable value for ThC″(Tl^{208}_{81}) second level of excitation moment and for γ radiation the E(2) with a small addition of M(1). The fourth excitation level has the value 3, however it is not yet possible to give a single sign for its parity, and it may be M(1) or E(1). (R.V.J.)

8119

INVESTIGATIONS OF SHORT-LIVED ISOMERS Y^{89*} AND Pb^{206*}. I. A. Kondurov, L. I. Rusinov, and V. B. Chernyaev. (Leningrad Inst. of Physics in Technology, Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1461-6(1956) Dec. (In Russian)

A pulsed radiation source combined with time and amplitude analyzers was used in the investigation of short-lived metastable states in the lifetime interval of 10^{-5} to 10^{-1} sec. A synchrotron of 100 Mev with 50 Hz pulse repetition frequency and 15 mk sec effective width of pulse radiation

bremsstrahlung was used as the pulsed γ-radiation source. The scheme of the installation is described, and the diagrams of provisional pulse distribution at various points of the time analyzer in measuring the half decay periods are given. The scheme of the experiment in irradiation at the synchrotron, the calibration curves of the scintillation γ spectrometer, and the Pb^{206} and Y^{88} decay curves are presented. (R.V.J.)

8120

ON SYMMETRIES IN ELEMENTARY PARTICLE INTERACTIONS. B. D'Espagnat and J. Prentki (CERN, Geneva) and Abdus Salam (Imperial Coll. of Science and Tech., London). Nuclear Phys. 3, 446-55(1957) May.

The extent to which the number of independent coupling constants in the interaction Lagrangian of elementary particles can be reduced by various covariance requirements in [3]- and [4]-manifolds is investigated. (auth)

8121

THE BREAKDOWN OF PARITY CONSERVATION IN THE π-μ-e DECAY AND A TEST OF THE TWO COMPONENT NEUTRINO THEORY. G. B. Chadwick, S. A. Durrani, L. M. Eisberg, P. B. Jones, J. W. G. Wignall, and D. H. Wilkinson (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 2, 684-93(1957) May.

6149 complete π-μ-e events have been measured in nuclear emulsion. 3021 events were in ordinary Ilford G5 emulsion and 3128 were in G5 emulsion containing twice the usual amount of gelatin relative to halide. The angular correlation between the initial directions of motion of μ meson and electron, after possible edge effects have been eliminated, is of the form $1-(0.149 \pm 0.033)\cos\theta$ in ordinary emulsion and $1-(0.190 \pm 0.033)\cos\theta$ in diluted emulsion. This demonstrates conclusively the breakdown of parity conservation and charge conjugation in both steps of the π-μ-e process. It is shown that, with the aid of other data, the partial quenching of the μ meson's initial spin orientation may be eliminated from these data and the true correlation of the fundamental process obtained: it is $1-(0.283 \pm 0.060)\cos\theta$. This asymmetry is consistent with the prediction of the two-component neutrino theory with $(|f_A|^2+|f_V|^2)^{-1}(f_V f_A^* + f_A f_V^*) = 0.85 \pm 0.18$. (auth)

8122

SPECTRUM OF TARGET BREMSSTRAHLUNG AT SMALL ANGLES. A. Sirlin (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 106, 637-45(1957) May 15.

The combination of Schiff's energy-angle distribution for the radiated photons and a Gaussian-like theory of multiple scattering for the incident electrons is studied. The emphasis is placed on a detailed consideration of the influence of screening as expressed in the Schiff's theory. An expression for the forward radiation is first developed, which is valid for values of $\lambda \ll 1$ and for any value of ρ (λ and ρ being parameters which essentially measure the importance of multiple scattering and screening, respectively). This result shows that the deviations of the actual forward spectrum from the integrated spectrum of the intrinsic distribution are appreciable even for small values of λ, the corrections being largest for complete screening and negligible for no screening. The case of complete screening is then studied exactly both for the forward radiation and the angular distribution. The latter results show that the integrated spectrum approximation is a good one when $\theta \gtrsim \mu/E_0$ and $\lambda \ll 1$. In a particular case, the theory predicts that the angular distribution (normalized to unity at $\theta = 0$) is somewhat broader for complete screening than for no screening. An exact treatment of the forward radiation is given for the cases of complete screening and no screening. Finally, an expression is developed, which yields the same result as the exact treatment for complete screening and no screening and provides a good approximation for intermediate screening. (auth)

8123

COMPARISON OF THE REACTIONS $p + d \rightarrow H^3 + \pi^+$, $p + d \rightarrow He^3 + \pi^0$ AS A TEST OF CHARGE INDEPENDENCE. Kenneth C. Bandtel, Wilson J. Frank, and Burton J. Moyer (Univ. of California, Berkeley). Phys. Rev. 106, 802-8(1957) May 15.

The pair of reactions $p + d \rightarrow H^3 + \pi^+$ and $p + d \rightarrow He^3 + \pi^0$ have been investigated experimentally to see if the predictions of the theory of charge independence are fulfilled. Because of the low cross section (a few microbarns) and large background (heavy particles emitted at ~10° lab) the results do not provide as critical a test as might be hoped. It was found that there is a 50% chance that the ratio of the reaction cross sections $(p + d \rightarrow \pi^+ + H^3)/(p + d \rightarrow \pi^0 + He^3)$ is between 2.0 and 2.6. Charge independence predicts that the ratio should be exactly two. The experimental difficulties would be less at higher proton energies; this method would seem to provide a very stringent test of charge independence if the comparison could be made with sufficient accuracy. (auth)

8124

PARITY NONCONSERVATION AND THE THEORY OF THE NEUTRINO. James A. McLennan, Jr. (Lehigh Univ., Bethlehem, Penna.). Phys. Rev. 106, 821-2(1957) May 15.

The two-component neutrino theory of Lee and Yang and of Landau is discussed. It is shown that, for the free nuetrino, their equations are equivalent to the Majorana equations, and thus are invariant under the full Lorentz group. (auth)

8125

ANGULAR CORRELATION OF ANNIHILATION RADIATION FROM ORIENTED GRAPHITE. S. Berko, R. E. Kelley, and J. S. Plaskett (Univ. of Virginia, Charlottesville). Phys. Rev. 106, 824-5(1957) May 15.

Experimental results are reported on the angular correlation of annihilation radiation from oriented graphite. Two large NaI crystals were used to measure coincidence between collimated annihilation γ rays. The graphite crystal consisted of purified and annealed natural Madagascar single-crystal flakes which were well oriented and cold pressed into a disk. Typical sets of measurements are shown graphically. Theoretical interpretations of the results are briefly indicated. (B.J.H.)

8126

TEST OF NEUTRINO–ANTINEUTRINO IDENTITY. Clyde L. Cowan, Jr., and Frederick Reines (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 106, 825-6(1957) May 15.

On the basis of new spectroscopic data for the atomic masses of Nd^{150} and Sm^{150}, a re-evaluation was made of the expected and extreme mean lives of neutrinos and antineutrinos. It was concluded that the Majorana hypothesis that the neutrino is identical with the antineutrino is not applicable. (B.J.H.)

8127

EVIDENCE FOR CIRCULAR POLARIZATION OF BREMSSTRAHLUNG PRODUCED BY BETA RAYS. M. Goldhaber, L. Grodzins, and A. W. Sunyar (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 106, 826-8(1957) May 15.

The degree and sense of circular polarization produced by β rays was investigated using a source of $Sr^{90} + Y^{90}$ in equilibrium. A diagram is included of the analyzing equipment. Near the high-energy end of the spectrum, it was found that the photons are almost completely circularly polarized with their spins antiparallel to their direction of propagation. (B.J.H.)

8128
CIRCULAR POLARIZATION OF BREMSSTRAHLUNG FROM POLARIZED ELECTRONS IN BORN APPROXIMATION. Kirk W. McVoy (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 106, 828-9(1957) May 15.

The Bethe-Heitler bremsstrahlung cross section was re-derived for transitions from specific initial to final electron spin states. The calculated circular polarization of the bremsstrahlung was compared to experimental results. (B.J.H.)

8129
PHENOMENOLOGICAL TWO-NUCLEON POTENTIAL UP TO 150 Mev. P. S. Signell and R. E. Marshak (Univ. of Rochester, N. Y.). Phys. Rev. 106, 832-4(1957) May 15.

An investigation was made of the consequences of adding a spin-orbit term to the Gartenhaus potential for two nucleons. Results of exact calculations of p-p and n-p scattering cross sections and polarizations using this potential are shown graphically. (B.J.H.)

8130
THE COLLECTIVE MODEL OF NUCLEAR MOTION. R. E. Peierls and J. Yoccoz (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) A70, 381-7(1957) May.

Collective motions of a many-body system, such as translation, rotation and oscillation, may be incorporated approximately in a shell-model description by regarding the shell-model wave function as a trial function for a variational approach, and exploiting the fact that the expectation value of the energy is then independent of the location and orientation, and approximately independent of the size and shape of the potential well. If these degeneracies are removed in the usual way, one is led naturally to wave functions containing both shell-model and collective aspects and to approximate values for the translational, rotational and vibrational energies. (auth)

8131
EFFECTS OF DYNAMIC DISTORTIONS OF NUCLEAR MAGNETIC RESONANCE SIGNALS ON MAGNETIC MEASUREMENTS. S. S. Kurochkin. Zhur. Tekh. Fiz. 27, 748-52(1957) Apr. (In Russian)

The nuclear magnetic resonance signals were calculated for the case of magnetic field linear variations (or frequencies), and parameters were determined for dynamic distortions of signals which must be considered in application of nuclear magnetic resonance for magnetic measurements. (R.V.J.)

8132
NUCLEAR PHYSICS. Victor F. Weisskopf (Massachusetts Inst. of Tech., Cambridge). Revs. Mod. Phys. 29, 174-81 (1957) Apr.

The problem of drawing conclusions in regard to structure and properties of nuclei from the present incomplete knowledge of nucleon interactions is discussed in detail. Some attempted explanations are given of such observed facts as the existence of nuclear matter, the independent particle aspect, the deviation from sphericity in many nuclei, problems connected with the interpretation of ensuing rotational spectra, and material accumulated in the study of nuclear reactions. Calculations are made on the basis of the independent particle model. A more general scheme for the description of nuclear reactions that allows for phenomena which do not fall within the framework of the old two-stage description is proposed. (M.H.R.)

8133
NUCLEAR SHELL MODELS. J. H. D. Jensen (Univ. of Heidelberg, Germany). Revs. Mod. Phys. 29, 182-5(1957) Apr.

The history of the nuclear shell model is outlined briefly. A summary is given of a few of the numerous calculations which have shown that the shell model can account for a great number of quantitative nuclear data as well as for general features of nuclear structure if correlation effects are properly accounted for by the introduction of mixed configurations. It is pointed out that this practical success must, however, be solidified by a general proof that the Hartree method is self-consistent for the nucleus. (M.H.R.)

8134
COLLECTIVE MOTION IN THE NUCLEUS. Ben R. Mottelson (Univ. of Copenhagen, Denmark). Revs. Mod. Phys. 29, 186-90(1957) Apr.

The fact that the nuclear field is generated entirely by the nucleons themselves implies that the nucleus will be much less stable in shape than the atom. In the regions farthest from closed shells, the nuclei possess a non-spherical shape as a consequence of the polarizing effect of the nucleons outside of closed shells. The lowest excitation state of the even-even nuclei are then rotations. With the approach to a closed shell configuration, the lowest excitations correspond to approximately harmonic shape oscillation of the harmonic type. Spectra are included to illustrate this. (M.H.R.)

8135
NUCLEAR REACTIONS. A. M. Lane (Atomic Energy Research Establishment, Harwell, Eng.). Revs. Mod. Phys. 29, 191-9(1957) Apr.

Cross sections for scattering and absorption are discussed with emphasis on parametric analysis, complex potential representation, evidence for the optical properties of nuclear matter, the special situation at low energies, and the strength function representation. Topics included in studying individual cross sections are statistical theories of reactions and surface reactions at energies $\lesssim$ 20 Mev. (M.H.R.)

8136
WEAK INTERACTIONS BETWEEN "OLD" PARTICLES AND BETA DECAY. Louis Michel (Inst. of Physics, Lille, France). Revs. Mod. Phys. 29, 223-30(1957) Apr.

Fermi interactions are discussed with emphasis on electrons, neutrinos, and mesons. (M.H.R.)

NUCLEAR PROPERTIES

8137 BNL-325(Suppl. 1)
[Nuclear Cross Sections Advisory Group, AEC].
NEUTRON CROSS SECTIONS. Supplement No. 1. Donald J. Hughes and Robert B. Schwarts [Brookhaven Neutron Cross Section Compilation Group]. Jan. 1, 1957. 154p. $1.75(GPO).

A thermal cross section table, resonance parameters, and cross section curves are included. (M.H.R.)

8138 CRP-690
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A REVISED SEMI-EMPIRICAL ATOMIC MASS FORMULA (WITH APPENDED TABLE OF MASS EXCESSES AND NUCLEAR REACTION ENERGIES). A. G. W. Cameron. Mar. 1957. 118p. (AECL-433).

A new mass formula has been constructed which contains volume and surface energies, each with a symmetry energy contribution, Coulomb and Coulomb exchange energies, and shell correction and pairing energies. A nuclear model with a trapezoidal radial-density distribution was used. The central density was assumed constant, and the dimensions were adjusted to fit the Stanford electron-scattering results. The symmetry energy coefficients were determined by a least-squares fit to the valley of beta stability. The volume and surface energy coefficients were deter-

mined by a least-squares fit to 89 odd-odd masses uniformly spaced in mass number. The shell correction and pairing energies were assumed to be independent functions of the proton and neutron numbers; they were empirically determined from the differences between masses computed from the formula without corrections and those tabulated by Wapstra and Huizenga. The median energy difference between the corrected formula and the Wapstra-Huizenga masses is about 300 kev. Some remarks are made concerning the implication of these results for nuclear deformations and fission thresholds. About 8000 mass excesses with associated particle binding energies and beta decay energies are given in an appendix. (auth)

8139 DP-207

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

MEASUREMENT OF THE CAPTURE CROSS SECTION OF THORIUM. James W. Wade. Feb. 1957. 11p. Contract AT(07-2)-1. $0.15(OTS).

The Standard Pile of the Savannah River Laboratory was used to compare the neutron absorption cross sections of thorium metal obtained from Ames Laboratory and Fernald. All samples had the same relative cross sections within an experimental accuracy of ±0.05 barn. Comparison of the thorium absorption with that of a sample of iron, taken to have a cross section of 2.53 barns for thermal neutrons, indicated a thermal absorption cross section of 7.55 ± 0.025 barns for thorium. (auth)

8140 IDO-16329

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CRYSTAL SPECTROMETER NEUTRON TOTAL CROSS SECTION MEASUREMENTS ON Np-237 FROM 0.02 TO 2.8 EV. M. S. Smith, R. R. Smith, E. G. Joki, and J. E. Evans. Mar. 25, 1957. 18p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

The total neutron cross section of Np^{237} has been measured in the energy region 0.02 to 2.8 ev with the MTR crystal spectrometer. Measurements were made on a sample containing 152 mg of Np^{237} in oxide form dissolved in deuterated nitric acid. A value for the absorption cross section at 0.025 ev of 170 ± 22 barns was obtained. Resonances were observed at energies 0.489 ± 0.002, 1.337 ± 0.015, and 1.488 ± 0.018 ev, with the respective values of $\sigma_0\Gamma$ being 84.2 ev barns, approximately 29 ev barns, and approximately 140 ev barns. Values for σ_0 of 2600 ± 100 barns, Γ of 0.032 ± 0.003 ev, and $g\Gamma_n$ of 0.016 mv were determined for the 0.489 ev resonance. (auth)

8141 TNCC(US)-17

Brookhaven National Lab., Upton, N. Y.

BASIS OF U.S. BEST VALUES FOR CROSS SECTIONS OF U^{233}, U^{235}, AND Pu^{239}. D. J. Hughes, R. S. Carter, and R. B. Schwartz. [1957]. 5p. $1.80(ph OTS); $1.80(mf OTS).

The manner in which the U.S. best values were obtained from the many experimental results during the last decade is described. (M.H.R.)

8142

COULOMB EXCITATION OF NUCLEI INDUCED BY NITROGEN IONS. D. G. Alkhazov, D. S. Andreev, et al. (Leningrad Inst. of Physics in Technology, Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser Fiz. 20, 1365-76(1956) Dec. (In Russian)

Coulomb excitations of F, Na, V, Mn, Ge, Se, Mo, Rh, Ag, Cd, In, I, Ta, W, Au, and Pb nuclei induced by N ions were investigated and their energies at lower levels of excitations were determined. Graphs of σ_a/σ_π relations to ζ_π at various values of $k = \Delta E/E_\pi$ are analyzed. The 0 curves were calculated by the formula of the semi-classical theory adequate with $k \to 0$. Experiments were performed with triple-charged N ions with energies of 15.6 Mev. The table for nuclear excitations (γ quanta determined with the accuracy of 1 to 3%) and diagrams of γ spectra in V, Mn, Ge, In, Ta, Au, and Pb Coulomb excitations are included. (R.V.J.)

8143

ANGULAR DISTRIBUTION AND EFFECTIVE CROSS SECTION OF THE REACTION $Li^7(p,\alpha)\alpha$ BELOW 600 Kev. Ewe Timm. Naturwissenschaften 44, No. 9, 279(1957). (In German)

8144

THE COULOMB EXCITATION OF U^{235}, Pu^{239}, AND U^{238}. J. O. Newton (Atomic Energy Research Establishment, Harwell). Nuclear Phys. 3, 345-63(1957) May.

Gamma rays from the Coulomb excitation of U^{235}, Pu^{239} and U^{238} have been observed with a xenon filled proportional counter. Energies of 46.23 ± 0.2, 56.74 ± 0.3 and 103.2 ± 1 kev with U^{235}, 49.6 ± 0.3 and 57.5 ± 0.3 kev with Pu^{239} and 44.7 ± 0.2 kev with U^{238} were obtained. The gamma rays are interpreted as arising from the decay of rotational states. From the absolute cross sections and from the branching ratios of the gamma rays from the second rotational states the reduced transition probabilities B_{E2} and intrinsic quadrupole moments Q_0 were estimated. Mean values for Q_0 of 10.1, 9.2 and 10.3 barns were obtained for U^{235}, Pu^{239} and U^{238} respectively. Possible assignments of single particle states in a deformed potential to the ground states of U^{235} and Pu^{239} are discussed. (auth)

8145

THE INFLUENCE OF l-FORBIDDENNESS OF MAGNETIC DIPOLE TRANSITIONS IN Tl^{203}. Torsten Lindqvist and Ingvar Marklund (Inst. of Physics, Uppsala, Sweden). Nuclear Phys. 3, 367-74(1957) May.

The angular correlation of the 400 kev−279 kev cascade in Tl^{203} has been measured. The correlation function has the form $w(\theta) = 1-(0.205 \pm 0.005)\cos^2\theta$. A comparison between the mixing ratio of the 400 kev transition ($d_{\frac{5}{2}} \to d_{\frac{3}{2}}$) and the mixing ratio of the 279 kev transition ($d_{\frac{5}{2}} \to s_{\frac{1}{2}}$) is done. The l-forbidden M1 transition is retarded by a factor of 1.3×10^{-3} compared to the l-allowed M1 transition. (auth)

8146

SCATTERING OF FAST NEUTRONS BY NEON IN THE ENERGY REGION 1.9 TO 3.5 Mev. C. P. Sikkema. Nuclear Phys. 3, 375-84(1957) May.

The scattering of monoenergetic neutrons by neon in the neutron energy range 1.9 to 3.5 Mev has been investigated by measuring the neon recoils in a multiple-wire proportional counter with which a γ-ray background can be reduced to a very low value by an anticoincidence technique. Approximate values for the total cross-section are obtained, which show resonance peaks at 1.94, 2.00, 2.11, (2.45), 2.57, 2.73, 2.88, 3.28, and 3.37 Mev neutron energy. By the study of angular distributions the resonances at 1.94 and 2.00 Mev could be ascribed to a $3/2^+$ and a $3/2^-$ level in the Ne^{21} nucleus respectively. The strong resonance at 2.11 Mev seems to be due to both a $3/2^+$ and a $3/2^-$ level. (auth)

8147

AN INVESTIGATION OF THE REACTION $^{23}Na(d,n)^{24}Mg$. F. A. El Bedewi and M. A. El Wahab (Univ. of Alexandria). Nuclear Phys. 3, 385-90(1957) May.

The photographic plate technique has been used to investigate the neutrons emitted from the disintegration of sodium by 8 Mev deuterons. The angular distributions of some neutron groups have been compared with curves calculated from the known deuteron stripping theories. A new level in Mg^{24} at 10.46 ± 0.10 Mev is found to have even parity and spin 1 or 2. (auth)

8148

ELECTRON CAPTURE IN ARSENIC 74 AND ARSENIC 76. J. Scobie (Univ. of Glasgow). Nuclear Phys. 3, 465-70 (1957) May.

The radiations of As^{74} and As^{76} have been studied, using proportional tube spectrometers with gaseous sources of radioactive arsine. Peaks have been observed in the As^{74} pulse spectrum, corresponding to the K and L radiations of germanium emitted in the electron capture decay to Ge^{74}. From the number of counts in the observed peaks and the total number in the pulse spectrum the ratio of electron capture to electron emission was found to be 0.67 ± 0.04. The ratio of L to K capture, determined from the relative areas under the electron capture peaks, is 0.085 ± 0.020, in agreement with the theoretical value of 0.095. A search has been made for electron capture in As^{76}, using a proportional counter with an internal anti-coincidence system to reduce wall-effect. No K-capture was observed with an intensity greater than 0.02% of the negatons. (auth)

8149

POLARISATION IN THE ELASTIC SCATTERING OF NEUTRONS BY HELIUM. R. E. White and F. J. M. Farley (Auckland Univ. Coll., New Zealand). Nuclear Phys. 3, 476-8(1957) May.

The polarization of neutrons in elastic scattering by helium is studied using polarized neutrons from a D–D source and observing the left-right asymmetry of recoil tracks in a helium-filled proportional counter. The polarization is 0.46 ± 0.18 for 3 Mev neutrons. (auth)

8150

THE ENERGY LEVELS OF Hf^{177} AND THE UNIFIED MODEL. S. Ofer (Hebrew Univ., Jerusalem). Nuclear Phys. 3, 479-90(1957) May.

A study of the γ-ray transitions between levels of Hf^{177} resulting from the β decay of Lu^{177} has been made using fast-slow coincidence technique. The results and the proposed spin and parity assignments are discussed in the light of the unified model. A value of 0.2 is derived for the gyromagnetic ratio associated with the collective rotational motion. (auth)

8151

STATISTICAL EVALUATION OF FISSION-PRODUCT ABSORPTION CROSS SECTIONS AT INTERMEDIATE AND HIGH ENERGIES. P. Greebler, H. Hurwitz, Jr., and M. L. Storm (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, 334-51(1957) May.

The use of the statistical properties of nuclear resonances to calculate fission-product poisoning in the intermediate energy range is described. On the basis of the available theoretical and experimental information, estimates of the average fission-product cross section as a function of energy are given for the energy range 10^2 to 10^6 electron volts. Comparison is made with direct experimental measurements of intermediate energy absorption cross sections for several isotopes. Because of the unusually large level spacings for target nuclei which have even proton and neutron numbers or near-magic neutron numbers, the average fission-product cross sections obtained here are lower than those obtained in estimates which ignore this effect. The influence of various assumed statistical distributions of reduced neutron widths on the average cross section is discussed. (auth)

8152

THE EXCITATION OF A 2.79 MeV LEVEL IN ^{19}F BY INELASTIC NEUTRON SCATTERING. Joan M. Freeman (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 628-34(1957) May.

Gamma rays of energy 2.594 ± 0.015 Mev have been observed following the inelastic scattering in F^{19} of neutrons in the energy range 3.2 to 3.7 Mev. They are attributed to a level at 2.791 ± 0.015 Mev which decays principally by a transition to the second excited state at 197 kev. The cross section for production of these gamma rays has been measured as a function of neutron energy and the result compared with the predictions of the Hauser–Feshbach model for different values of the spin of the level. It is concluded tentatively that the spin of the 2.79 Mev level is either 9/2 or 7/2. (auth)

8153

COLD NEUTRON SCATTERING IN ALUMINIUM. L. S. Kothari and K. S. Sigwi (Atomic Energy Establishment, Bombay, India). Phil. Mag. (8) 2, 694-6(1957) May.

An attempt has been made to increase the agreement between calculated and experimental values for scattering of cold neutrons from Al at 800°K. It is found that at high temperatures the effect of the variation of Debye temperature is more important than the correction to the inelastic approximation. (M.H.R.)

8154

CIRCULAR POLARIZATION OF γ-RAYS: FURTHER PROOF FOR PARITY FAILURE IN β DECAY. H. Schopper (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 2, 710-13(1957) May.

The results reported here confirm the expectation that the γ rays emitted after β decay at an angle θ relative to the β particle should show circular polarization proportional to cos θ. Co^{60} and Na^{22} were used for this work. The experimental set-up is diagrammed and the results are tabulated. (M.H.R.)

8155

NUCLEAR LEVELS IN Si^{28} AND P^{31}. P. M. Endt (Fysich Lab. der Rijksuniversiteit, Utrecht, The Netherlands) and C. H. Paris (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 764-6(1957) May 15.

Lead-phosphate targets have been bombarded with protons accelerated by an electrostatic generator to energies of 6.5 and 7.0 Mev. Charged reaction products (alpha particles and elastically and inelastically scattered protons) were observed at 50, 90, and 130 degrees to the proton beam with a high-resolution magnetic analyzer. The ground-state Q-value of the $P^{31}(p,\alpha)Si^{28}$ reaction has been measured as 1.909 ± 0.010 Mev. Levels were observed in Si^{28} at 1.771 and 4.617 Mev and in P^{31} at 1.267, 2.234, 3.133, 3.293, 3.414, 3.505, 4.188, 4.257, 4.430, 4.590, 4.633, 4.784, and 5.012 Mev. (auth)

8156

$F^{19}(n,d)O^{18}$ REACTIONS AND ENERGY LEVELS OF O^{18}. F. L. Ribe (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 106, 767-71(1957) May 15.

The differential cross sections for the reactions $F^{19}(n,d)O^{18}$ leading to the ground- and first-excited states of O^{18} have been measured. Higher excited states were also observed but with insufficient accuracy for measurement of the corresponding cross sections. Comparison with results of pickup theory indicates a proton s-wave transition to the ground state of O^{18} and a probable d-wave transition of approximately equal reduced width to the first excited state. The estimated ratio of the two reduced widths is in agreement with recent theoretical results. (auth)

8157

ANGULAR DISTRIBUTION OF GAMMA RAYS FROM COULOMB EXCITATION OF Pt AND W. W. I. Goldburg and R. M. Williamson (Duke Univ., Durham, N. C.). Phys. Rev. 106, 782-4(1957) May 15.

Data on the unresolved 330- and 358-kev gamma rays from thin natural platinum bombarded by 2- to 4-Mev protons show that the anisotropy of the angular distribution agrees closely with first order Coulomb excitation theory. The thick-target anisotropy of the 114-kev gamma rays

from natural tungsten was found to be much more isotropic than the theory predicts. This result can be explained by assuming an extranuclear interaction between the excited tungsten nuclei and electric field gradients within the tungsten lattice. (auth)

8158

DETERMINATION OF THE SIGN OF THE He^3 NUCLEAR MAGNETIC MOMENT. Melvin P. Klein and Bert E. Holder (Univ. of California, Livermore). Phys. Rev. 106, 837-8(1957) May 15.

The nuclear induction method was used to compare the signs of the nuclear magnetic moments of the proton and the He^3 nucleus. It was found that the He^3 nuclear magnetic moment is negative. (B.J.H.)

8159

NUCLEAR REACTIONS IN NATURE. A. K. Lavrukhina. (Moscow Vernadskii Inst. of Geochemistry and Analytical Chemistry). Priroda 46, No. 3, 24-30(1957) Mar. (In Russian)

A review is given of data on nuclear reactions in nature. (R.V.J.)

8160

ON THE MOMENTS OF INERTIA OF NUCLEI. J. Yoccoz. Proc. Phys. Soc. (London) A70, 388-97(1957) May.

The variational method developed in the previous paper is applied to the calculation of nuclear moments of inertia using an anisotropic harmonic well and neglecting spin–orbit couplings. The inter-nucleon forces are assumed to have a Gaussian form, either with zero range or with a realistic range, and in the latter case either for ordinary (Wigner) forces or for a Serber mixture. The results are shown in the figure. While with such a crude model no detailed agreement can be expected, the orders of magnitude and the trend of the results are encouraging. (auth)

8161

A VARIATIONAL CALCULATION OF THE CROSS SECTION FOR THE 1s–2s EXCITATION OF HYDROGEN BY ELECTRON IMPACT. B. H. Bransden (Univ. of Glasgow) and J. S. C. McKee (Queen's Univ. of Belfast). Proc. Phys. Soc. (London) A70, 398-400(1957) May.

The variational method, with simple polynomial trial wave functions, has been extended to inelastic collisions, by means of a calculation of the zero order 1s–2s electron excitation of hydrogen atoms. Results are given for trial wave functions containing one, two, or three terms. (M.H.R.)

8162

TECHNIQUES FOR MEASURING ELASTIC AND NON-ELASTIC NEUTRON CROSS SECTIONS. L. Cranberg, R. B. Day, L. Rosen, R. F. Taschek, and M. Walt (Los Alamos Scientific Lab., N. Mex.). Progr. Nuclear Energy 1, Ser. 1, 107-60(1956).

Techniques for measuring elastic and non-elastic neutron cross sections are discussed. The present status of neutron and gamma-ray spectroscopy, as applied to the determination of differential neutron cross sections, is reviewed. Descriptions of the various experimental methods currently in use are illustrated with representative results. (auth)

NUCLEAR REACTORS

8163 APAE-Memo-86

Advanced Scientific Techniques Research Associates, Milford, Conn.

THE EFFECT OF GAMMA HEATING ON THE APPR-1 PRESSURE VESSEL—NEW DESIGN. H. R. Kroeger. July 1956. 33p. For [Alco Products, Inc. Contract AT(11-1)-318]. (ASTRA-415-E-2-2). $0.25(OTS).

The effect on pressure vessel stress of reducing the inside diameter of the vessel is examined. Although a reduction in diameter decreases the pressure stress, the vessel is exposed to a higher incident gamma energy, and the resulting thermal stress is increased. Design guides for an optimum system are given. Results of experiments are tabulated. (M.H.R.)

8164 APEX-303

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SYNTHETIC EXPERIMENT DESIGN TECHNIQUES IN REACTOR ANALYSIS. J. M. Krase and C. Cyl-Champlin. Nov. 30, 1956. 39p. Contracts AF33(038)-21102 and A[T](11-1)-171. $0.30(OTS).

This report presents a method of establishing simple equations giving an empirical functional relationship between a dependent variable and a number of independent variables where the theoretical relationship is complex; that is, a set of complex equations is replaced with a simple equation. The techniques used in this method originated in the field of statistical experiment design and have been adapted to the engineering analysis of reactor nuclear characteristics. (auth)

8165 CF-54-9-140

Oak Ridge National Lab., Tenn.

SUMMARY OF LOW-ENRICHMENT RESEARCH REACTOR CALCULATIONS. M. C. Edlund. Sept. 23, 1954. Decl. Apr. 11, 1957. 7p. [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Critical masses, neutron fluxes, power levels, and fuel element specifications were estimated as a function of U enrichment for MTR, swimming pool, water boiler, and CP-5 types of research reactors. The critical masses are shown as a function of enrichment. (B.J.H.)

8166 CF-57-4-64

Oak Ridge National Lab., Tenn.

TEMPERATURE EFFECTS ON THE MEASUREMENT OF AQUEOUS LIQUID LEVEL BY THE DIFFERENTIAL PRESSURE METHOD AND RECOMMENDATIONS FOR PLACEMENT OF TAPS ON THE HRT REPLACEMENT HEAT EXCHANGER. R. L. Moore. Apr. 26, 1957. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Increasing temperature in an aqueous liquid system results in a decrease in liquid density and an increase in vapor density. When level is measured by the differential pressure method, temperature increase results in a decrease in the effective span of the instrument and a shift in zero. When the instrument reference leg is uncompensated, both zero and span shifts occur with the effects being most pronounced at the higher levels. When the reference leg is compensated, zero shifts are eliminated (instrument zero is at 100% level for this type installation). For control purposes at levels above 50% of full level, the compensated reference leg installation will give the best results. For measurement of levels below 50%, the uncompensated installation is best. As errors in level indications will be produced, in either type installation, by temperature, pressure and steam withdrawal (power) effects, the placement of taps should be such as to place the normal or control level in the region of 50% indicated level. Recommendations are made with respect to the placement of the three taps on the replacement heat exchanger. It is further recommended that two level instruments be installed. One instrument should be connected between the upper and middle taps and would be used for control. The other instrument should be connected between the upper and lower taps and would be used for indication of levels below the control range. The reference leg of the controlling

instrument should be compensated. The reference leg of the indicating instrument should be uncompensated. (auth)

8167 CF-57-4-137
Oak Ridge National Lab., Tenn.
OBSERVED PRESSURE DROP ACROSS HRT OFF-GAS ADSORBER UNITS (CHARCOAL BEDS) AT VARIOUS FLOWS OF OXYGEN. R. Van Winkle. Apr. 17, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A plot of the pressure-drop data shows that the pressure drop through a single HRT off-gas adsorption unit is equal to 2.66 times the O_2 flow (measured in liters/min at 70°F, 14.7 psia). (T.R.H.)

8168 CF-57-6-20
Oak Ridge National Lab., Tenn.
OBSERVED NET HEAT LOSS FROM THE HRT HIGH-PRESSURE SYSTEM. R. Van Winkle and R. R. Wiethaup. June 4, 1957. 4p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

An estimate has been obtained of the heat that should be generated in the HRT core in order to hold the system at operating temperature under no-load conditions. This estimate was made by measuring the feed-water rate to the package boiler during an oxygenated water run. Results are summarized. (M.H.R.)

8169 DTMB-1101
David W. Taylor Model Basin, Applied Mathematics Lab., Carderock, Md.
NUCLEAR REACTOR CALCULATIONS AT DAVID TAYLOR MODEL BASIN. Erwin H. Bareiss. Feb. 1957. 33p.

This report is a reprint of Applied Mathematics Lab. Technical Report No. 15, dated Feb. 1956.

Two representative projects involving nuclear reactor calculations performed on electronic computers are discussed. The first, leading to the Cuthill code, is based on the diffusion theory and the second is based on the more refined transport theory. The mathematical procedures underlying these approaches to the solution of problems in reactor design are described in detail. (auth)

8170 HW-49029
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SURVEY OF MATERIALS FOR ORGANIC COOLED REACTOR PRESSURE TUBING. Alan B. Burgess. [Mar. 27, 1957]. 29p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

A comparison was made of various materials which have been suggested for use as process tubing at temperatures up to 400°C. Mg alloys, Al alloys, Zircaloy-2, and mild steel were considered. Using the limited available data, the variation of required tube wall thickness with coolant temperature was determined for a set of typical conditions proposed for an organic cooled reactor. On the bases of mechanical strength and thermal neutron absorption properties, Zircaloy-2 is the best material for tube temperatures above 200°C. However, because of the incompatibility of Zircaloy-2 and organic coolants, the Al alloy, M-257, was found to have the greatest potential for use as pressure tubing material in an organic cooled reactor at temperatures from 250 to 450°C. (auth)

8171 IDO-16361
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
TABLE OF REACTIVITY VALUES FOR THE RMF CALCULATED FROM THE INHOUR EQUATION. E. Fast. Aug. 20, 1956. 16p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

8172 KAPL-M-AME-6
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G INSTRUMENTATION WELDING. Robert L. Harris. Feb. 28, 1957. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Welding tests were conducted to determine feasibility and establish procedures for S3G instrumentation welding. (D.E.B.)

8173 MMPP-75-3
Michigan. Univ., Ann Arbor. Michigan Memorial-Phoenix Project.
AN EVALUATION OF THE HAZARDS OF OPERATION AND PROVISIONS FOR LIMITING THESE HAZARDS. William K. Luckow, Russell B. Mesler, and Lawrence C. Widdoes. Oct. 8, 1954. 17p. Phoenix Project No. 75. Contract AT(11-1)-224. $3.30(ph OTS); $2.40(mf OTS).

The operation and control of the Michigan Research Reactor and its safety features are described in this request to AEC for authorization to operate the reactor. (T.R.H.)

8174 NAA-SR-1864
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REACTOR PHYSICS PROGRESS REPORT [FOR] MAY 1955–DECEMBER 1956. M. Carl Walske, ed. May 15, 1957. 20p. Contract AT-11-1-GEN-8. $0.20(OTS).

The disadvantage factors have been measured for one-inch-diameter thorium rods inserted in a lattice of one-inch-diameter 0.9-per cent enriched uranium rods in graphite. Similar measurements were made for rods of thorium alloyed to 2, 3, and 4 per cent with U^{235}. The elementary age theory of the slowing down of neutrons has been improved by estimating the energy at which slowing-down ceases and at which the neutron may be considered to make the transition to a thermal distribution. This has been accomplished by means of a comparison with slowing-down theories which take into account the thermal motion of the moderator. The comparison must be made with respect to a single parameter; this may be either the migration area of thermal neutrons, the migration area to absorption, or the mean number of collisions before absorption. A straightforward comparison theory used at first differed from the elementary theory only in that the mean energy loss was made proportional to E-2kT, rather than to E; later, however, the Wilkins theory of slowing-down was applied. Using this theory, and basing the comparison on the mean number of collisions before absorption, the transition energy was found to be five times thermal. In connection with the application of Wilkins' theory, Wilkins' differential equation has been solved explicitly to the second order in the absorption parameter Δ. In addition, this equation has been programmed for solution on the IBM 704. The treatment of resonance escape probability in the elementary slowing-down theory has also been improved by the use of Wilkins' equation. The effect for a sharp resonance has been calculated generally, and the effect for a broad resonance not actually in the thermal range has been estimated in the WKB approximation. The result of the latter calculation is that the usual factor E^{-1} in the resonance integral must be replaced by $(E-2kT)^{-1}$, which is in agreement with the first comparison theory of the first paragraph above. The result for a sharp resonance is the same, provided that the resonance is not in the thermal range. (auth)

8175 NAA-SR-Memo-702
North American Aviation, Inc., [Downey, Calif.]
NEUTRON LEAKAGE FROM THE 30 MEGAWATT SGR–P4 REACTOR. F. L. Fillmore. Aug. 21, 1953. Decl. May 22, 1956. 44p. $0.55(OTS).

The fast and thermal neutron leakage from the 30-Mw SGR-P4 reactor has been studied by three independent methods. These are the age equation, the two-group flux equations, and the leakage probability methods. The appropriate reactor constants calculated in another report are summarized here. Results are tabulated. Values obtained are for radial leakage only. Axial leakage can be analyzed by the same procedures, though complicated by neutron streaming through the process tube channels. (M.H.R.)

8176 SWP/P-27

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE TRANSMISSION OF THERMAL NEUTRONS IN A STRAIGHT ANNULAR DUCT. C. C. Horton, D. B. Halliday, J. R. A. Lakey, and J. R. Harrison. Jan. 1956. 10p.

The transmission of thermal neutrons in straight annular ducts through the BEPO reactor shield has been investigated over the range $1 < x/R_{eff} < 60$, where R_{eff} is related to the cross-sectional area of the duct by the expression $\pi R^2_{eff} = A$ and x is the distance along the duct. It is found the results can be fitted by a theoretical formula using a calculated value of the albedo for the duct wall. (auth)

8177 UCRL-4813

California. Univ., Livermore. Radiation Lab.

BEEHIVE AND HORNET—REACTOR CODES FOR SPHERICAL GEOMETRY. Stuart P. Stone. Feb. 8, 1957. 72p. Contract W-7405-eng-48. $12.30(ph OTS); $4.50 (mf OTS).

Beehive is a five energy group, two region, time independent, spherical reactor code. It considers the problem of a reactor system in which the core material is assumed to be at a higher energy (temperature) than the reflector material. The code obtains a closed solution for the critical reactor assembly by a procedure which is a logical extension of normal two group theory. The companion code, Hornet, computes the neutron fluxes for the critical assembly determined by the Beehive calculation. Both codes have been programmed for the IBM 650. The codes, together with the flow diagrams, are included. (auth)

8178 WAPD-PM-44

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

WATER EJECTION FROM FUEL PILES BY EXPANSION OF PLASTIC TAPES. Emerson M. Pugh. Mar. 1956. 10p. $3.30(ph OTS); $2.40(mf OTS).

The hydrodynamic problems of water ejection were solved in a general form which allows the determination of pressures under various conditions. (D.E.B.)

8179 WAPD-PWR-CP-2585

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh].

STATUS OF THE PWR PROTOTYPE ANALYTICAL TRAIN. J. M. Wright and T. R. Durga. [Dec. 1956]. 29p. $4.80(ph OTS); $2.70(mf OTS).

The PWR analytical trains are to consist of a series of instruments which measure and record various properties of the coolant water. To make certain these trains will perform the functions desired, a prototype has been constructed and is being tested. The prototype train layout, the components in the train, and the tests which have been performed on these components are described. (M.H.R.)

8180

DOUNREAY: THE FAST REACTOR, THE SPHERE, THE REACTOR VAULT, THE CORE, THE CORE VESSEL, PRIMARY HEAT EXCHANGERS, SECONDARY HEAT EXCHANGERS, CIVIL ENGINEERING, AND ELECTRICAL EQUIPMENT. Nuclear Eng. 2, 230-44(1957) June.

8181

THE WORLD'S REACTORS. NO. 12. DOUNREAY. Nuclear Eng. 2, 238a(1957) June.

Detailed diagrams are given of the Dounreay Fast Reactor and its core vessel. The reactor specifications are summarized. (M.H.R.)

8182

LIDO. MEASUREMENT AND CONTROL. G. Chadwick and T. R. Thompson (Ericsson Telephones, Ltd.). Nuclear Eng. 2, 245-51(1957) June.

A general description of the instrumentation and control of the LIDO reactor at Harwell is given and the safety circuits and interlocks are discussed. (M.H.R.)

8183

THE HOMOGENEOUS AQUEOUS REACTOR. R. Hurst, I. Wells, and D. Newby (AERE, Harwell). Nuclear Power 2, 193-5(1957) May.

A design study of a homogeneous aqueous reactor as a power plant has been carried out at Harwell. A 100-Mw reactor of two zones with a UO_2/D_2O solution in the core and a ThO_2/D_2O slurry in the blanket was considered. This system is regarded as a self-contained breeding system generating its own fuel, and dependent only on the thorium supply for the blanket. Practical difficulties to be overcome before the reactor can be built are listed. (M.H.R.)

8184

CRITICALITY AND FLUX CALCULATIONS FOR HYDROGENOUS ASSEMBLIES. N. C. Francis, H. Hurwitz, Jr., and P. F. Zweifel (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, 253-87(1957) May.

The calculation of critical parameters, neutron distributions, and adjoint functions for reflected reactors is discussed. A variational technique and a modification of the Wiener-Hopf method are described. The major application is made for the case of reactors moderated by hydrogen, in which case the slowing-down kernel must be introduced either as a numerical function or as a polynomial fit to such a function. For the case of the polynomial fit, explicit formulas for critical size, neutron distributions, and adjoint functions have been found by the Wiener-Hopf method. A comparison with experimental results for water-moderated reactors shows discrepancies consistent with the discrepancy known to exist between the measured and calculated neutron age in water. (auth)

8185

CALIBRATION OF CONTROL RODS. F. J. Jankowski, D. Klein, and T. M. Miller (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, 288-302(1957) May.

Two methods for calibrating control rods are presented. A theoretical treatment is given of an oscillating technique and experimental results obtained by this method are compared with those obtained by the rod bump-period method. A second technique is described whereby a neutron source is suddenly removed from a subcritical reactor and the neutron levels before and after the change are compared. (auth)

8186

FAST NEUTRON DAMAGING IN NUCLEAR REACTORS. III. THE RADIATION DAMAGE DOSAGE. W. Primak (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 320-33(1957) May.

The portion of the neutron flux spectrum responsible for producing radiation damage in the light insulators is identified. A simplified method for describing the radiation damage dosage is devised to permit quantitative comparisons between the radiation damage developed in different reactor facilities. The damage rates in facilities of the following reactors are compared: X-10, CP-3', CP-5,

Hanford, BNL-1, and LITR; the relation of the damage rates to various quoted fluxes is indicated. It is shown that the damaging flux has no general relation to the total flux, the thermal flux, the resonance flux, or the epithermal flux; it must be monitored for each experiment. (auth)

8187

THE THERMAL SPECTRUM OF AN INTERMEDIATE ASSEMBLY. Mark Nelkin (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, 373-81 (1957) May.

The thermal spectrum of a beryllium-moderated intermediate assembly is calculated in the approximation of a heavy crystalline moderator. The results are compared to experiment, and the qualitative agreement is found to be good. In the particular case calculated, the temperature dependence of the spectrum is so weak that a straightforward Fermi age calculation is also in good qualitative agreement. The most important uncertainties in the calculation are due to the heterogeneous distribution of neutron absorbing material, and the use of the heavy mass approximation in the presence of strong absorption. (auth)

8188

REACTORS, HAZARDS VS POWER LEVEL. Thomas J. Burnett (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 382-93(1957) May.

The potential hazard resulting from the accidental release of the fission products accumulated in a reactor enters into both design and site selection. This hazard is associated principally with the resultant internal exposure which is greatest from isotopes with long half-lives. A useful index of a reactor's potential hazard is the accumulated number of activity quantities each capable of 25 rem total bone exposure. This hazard index is sensitive to the relative composition of these fission products and is given by the empirical equation: $HI = 112.5\ P^{0.37}\ (Pt)^{0.63}$, in which P is the power in watts at which the reactor is operated for t days. This equation, valid over the time range of principal interest (30 to 1000 days), permits comparison of potential hazard for constant burnup (the Pt product) and/or other design parameters. (auth)

8189

NUCLEAR REACTOR PHYSICS. Raymond L. Murray. Englewood Cliffs, Prentice-Hall, Inc., 1957. 325p.

Discussions are included on the nuclear reactor, neutron motion, flux distributions and critical mass, the heterogeneous reactor, the two-group theory, the time-dependent reactor, temperature effects on multiplication, reactor control, transport theory, and neutron slowing and multigroup methods. The principal emphasis is placed on the distributions in energy and space of neutron flux, the determination of the critical amount of fissionable material, and the transient behavior and control of the reactor as a heat source. Bessel functions, physical constants, and Laplace transforms are included in appendices. (M.H.R.)

NUCLEAR TRANSFORMATION

8190 NP-6315

Pennsylvania. Univ., Philadelphia.

A STUDY OF (n,p) REACTIONS OF SEVERAL MIDDLE WEIGHT ELEMENTS. Technical Report No. 2. Victor V. Verbinski. May 1957. 40p. Contract Nonr-551(17).

Measurements of the (n,p) reaction on several target elements using 14-Mev neutrons from the $He^3(d,n)He^4$ reaction are described. Target elements used were Mg, Al, Fe, Ni, Cu, Nb, Mo, Rh, Pd, and In. This work was done to gain some insight into the interaction mechanism for this nuclear reaction. Measurements of the spatial and spectral distributions of the emitted protons were made. Diagrams of the apparatus and graphs of the results are included. (M.H.R.)

8191 ORO-162

Emory Univ., Ga.

BOMBARDMENT ENERGY AND FISSION PRODUCT YIELD PATTERN: PROTONS ON Th-232, U-233, AND Th-230. William H. Jones. [1956]. 20p. Contract [AT(40-1)-1399]. $0.20(OTS).

Experimental methods are summarized. Yields of fission products are tabulated and graphed relative to that of Mo^{99}. (M.H.R.)

8192 AEC-tr-2757

ON THE PROBLEM OF LITHIUM, BERYLLIUM, AND DEUTERIUM CONTENT IN THE SOLAR ATMOSPHERE. I. S. Shklovskii (Shaklovsky). Translated from Doklady Akad. Nauk S.S.S.R. 105, 931-4(1955). 4p.

One possible mechanism for the production of Li, Be, and D in the outer layers of the sun is discussed. (T.R.H.)

8193

(γ,n) REACTIONS NEAR THRESHOLD AND FINE STRUCTURE IN CERTAIN MEDIUM ELEMENTS. Robert Basile. Ann. phys. 2, 267-308(1957) Mar.-Apr. (In French)

8194

ANGULAR DISTRIBUTIONS OF THE $B^{11}(d,n)C^{12}$ GROUND-STATE NEUTRONS. Oakes Ames, George E. Owen, and C. D. Swartz (Johns Hopkins Univ., Baltimore, Md.). Phys. Rev. 106, 775-8(1957) May 15.

The angular distributions of the ground-state neutrons from the reaction $B^{11}(d,n)C^{12}$ have been measured in the deuteron energy range of 0.500 to 1.15 Mev. A single stilbene crystal counter was employed as a neutron detector. At a bombarding energy of 0.8 Mev, the neutron angular distribution exhibits a strong forward component, while at 1.15 Mev, the distribution is more isotropic. The data are consistent with an analysis based on nuclear stripping theory. (auth)

8195

FISSION MODES OF $_{94}Pu^{242}$. A. B. Smith, P. R. Fields, and A. M. Friedman (Argonne National Lab., Lemont, Ill.). Phys. Rev. 106, 779-81(1957) May 15.

The neutron induced fission of Pu^{241} ($Pu^{241} + n_{th} = Pu^{242*}$) and the spontaneous fission of Pu^{242} were studied by using a back-to-back ionization chamber. The two processes were found to be asymmetric and essentially identical. The most probable values of the mass ratio and total fragment kinetic energy were measured to be 1.38 and 174 Mev, respectively. The experimental results are compared with those from other fission processes and with existing theory. (auth)

8196

FINAL-STATE INTERACTIONS IN THE TOTAL CROSS SECTION FOR DEUTERON PHOTODISINTEGRATION. Jeremy Bernstein (Harvard Univ., Cambridge, Mass.). Phys. Rev. 106, 791-2(1957) May 15.

The role of final-state interactions in the theory of the total cross section for photodisintegration of the deuteron at high energies was estimated. The Feshbach-Lomon model of nucleon-nucleon scattering was employed. Within the context of this model, final-state effects were found to enhance the total cross section by about 15 to 20% over the usual electric dipole calculation for photon energies around 60 Mev. (auth)

8197

ANGULAR DISTRIBUTION OF PHOTOPIONS FROM DEUTERIUM. D. C. Hagerman, K. M. Crowe, and R. M. Friedman (Stanford Univ., Calif.). Phys. Rev. 106, 818-20(1957) May 15.

Measurements have been made on the relative cross sec-

tion of positive pions made by 350-Mev bremsstrahlung for deuterium and hydrogen for laboratory angles between 30 and 90°. The ratio of the differential cross sections is essentially a constant to about ±5%. The mean pion laboratory energy of 75 ± 5 Mev was held constant for the different angles. The results compare qualitatively with those obtained from Watson's phenomenological theory for photopion production. (auth)

8198

PRODUCTION OF HEAVY MESONS AND HYPERONS BY PROTONS ON DEUTERIUM VIA SECONDARY PIONS. E. C. Fowler, H. D. Taft, and E. R. Mosburg (Yale Univ., New Haven, Conn.). Phys. Rev. 106, 829-31(1957) May. 15.

Estimates were made of the magnitude of the contribution of the two-step process to the production of heavy mesons and hyperons by protons on deuterium. A detailed outline is given for the estimation procedure. (B.J.H.)

PARTICLE ACCELERATORS

8199 ANL-5713

Argonne National Lab., Lemont, Ill.

PARTICLE ACCELERATOR DIVISION SUMMARY REPORT [FOR] OCTOBER 1956 THROUGH MARCH 1957. Apr. 1957. 46p. Contract W-31-109-eng-38. $0.35(OTS).

Discussions are included on magnet design, power supply, and coil design for the proposed synchrotron. The various electronic controls, the vacuum system, and instrumentation are discussed in detail. Some measurements of the properties of ferrites have been carried out and a permanent ferrite testing installation has been designed. Efforts have been made to attain the desired accuracy of tracking of the accelerating frequency with respect to the guide field and of reading out the instantaneous value of the pulsed guide field in the ring magnets. Diagrams of the various parts of the synchrotron and theoretical topics are included. (For previous period see ANL-5630.) (M.H.R.)

8200

TEST OF THE BLOCKS OF THE ELECTROMAGNET OF THE SACLAY SYNCHROTRON. G. Bronca, H. Bruck, J. Hamelin, and G. Neyret. Nuclear Instr. 1, 123-32 (1957) May. (In French)

After a brief description of the synchrotron magnet and the effects of the field inhomogeneities, the principle of the stacking procedure, the purpose of which is minimizing these effects, is described. To carry out this method a program of magnetic measurements was set up. Its principal practical set up and main results are given. The practical way for determining the azimuthal location of the blocks is developed. The gain of the operation with respect to a random distribution is estimated. (auth)

8201

ON THE MECHANISM OF ELECTRON CAPTURE IN BETATRONS. Yu. S. Korobochko. (Leningrad Kalinin Polytechnic Inst.). Zhur. Tekh. Fiz. 27, 745-7(1957) Apr. (In Russian)

The process of electron capture in acceleration was studied to determine the relation between the current injected into the betatron (I_{em}) and the orbital current circulating during the capture time. Calculations were developed on the basis of experiments which indicated that the current I exceeds I_{em} 4 to 5 times, because the largest part of electrons complete a considerable number of revolutions before they are captured. (R.V.J.)

RADIATION ABSORPTION AND SCATTERING

8202 AEC-tr-2738

THE DIFFUSION OF RADIATION WITH FREQUENCY SPREADING. [PART] I. V. V. Sobolev. Translated from Vestnik Leningrad. Univ. 10, 85-100(1955). 18p.

The coefficient of absorption for photons with frequency ν_1 with the subsequent emission of photons with frequency ν_2 is determined on the basis of the inherent spread of the atomic energy levels and the thermal motion of the atoms. Second, the diffusion equations for the radiations are set up and solved for the following three cases: 1) in the absence of any frequency spreading; 2) on the basis of a complete radiation frequency spreading; and 3) on the basis of the actual radiation frequency spreading. Finally, for each of the above cases, the values of various physical parameters (radiation density, radiation pressure, etc.) are found and the results are compared. (auth)

8203 AEC-tr-2741

CONCERNING A FORMULA FOR THE ANGULAR DISTRIBUTION OF PARTICLES SCATTERED IN A GAS. I. P. Skalskaya. Translated from Zhur. Tekh. Fiz. 24, 1912-14(1954). 3p.

The present work arose in connection with the calculation of the differential cross section for positive ions, which was performed by Fedorenko. The formulas used for calculating the cross section contained a factor which depends on the geometry of the apparatus; an approximate expression for the factor was derived by Jordan and Brode, and is presented without a derivation and without mention of the exact limits of application by these authors. The purpose of the present work is the verification of the results of Jordan and Brode and the derivation of a more exact expression for the above factor, which will make it possible to evaluate the degree of approximation inherent in the formula of these authors. (auth)

8204

ANGULAR AND ENERGY DISTRIBUTION OF FAST PHOTOPROTONS FROM Ni AND Al. E. B. Bazhanov, Yu. M. Volkovl, et al. (Leningrad Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 113, 65-7(1957) Mar. 1. (In Russian)

The angular and energy distributions of fast photoprotons from Ni and energy distribution of photoprotons from Al irradiated by bremsstrahlung of maximum energy 85 ± 5 Mev were studied with a scintillation telescope. Diagrams for the energy distribution of protons from Ni and Al escaping under 90° to the beam in the lab. system show the energy distributions for both elements as: f (Ep) ~ Ep^{-n}, where the n value for the proton spectra with energies above 33 Mev is more than twice the n value for the proton spectra with smaller energies. Positions of the proton energy curves are in good agreement with those calculated by the statistical deuteron photodisintegration theory. Angular distributions of Ni protons for two intervals 20 to 33, and 33 to 65 Mev are included. Results suggest application of the "quasideuteron" model for the γ quanta of $E_{\gamma\ max}$ = 86 ± 5 Mev. (R.V.J.)

8205

INTERACTION OF BETA PARTICLES WITH MATTER. Ralph H. Müller (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 969-75(1957) June.

A study of relative backscattering of beta particles from matter shows simple regularities for all elements and compounds. These can be measured with high precision. Values predicted for pure crystalline solids can be checked to a precision close to that with which atomic weights are known. Measurements are applied to solids, liquids, and solutions. (auth)

8206

INTERACTION OF BETA PARTICLES WITH ORGANIC COMPOUNDS. Doris Clegg Müller (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 975-8(1957) June.

General principles which govern backscattering of

beta particles from matter are applied to representative organic compounds. Anomaly of hydrogen, which exhibits negative scattering, is resolved and a reliable value is fixed for it. Proof is given that backscattering of compounds is accurate predictable from intrinsic scattering of constituent atoms. (auth)

8207

CONCERNING THE ELASTIC SCATTERING OF HIGH ENERGY PARTICLES. I. M. Khalatnikov (USSR Academy of Sciences, Moscow). Nuclear Phys. 3, 433-5(1957) May.

An error in a previous derivation of the scattering amplitude formula for large angles is pointed out and another derivation is given. (M.H.R.)

8208

CONSTRUCTION OF THE SCATTERING MATRIX OF A TWO-NUCLEON SYSTEM. L. Puzikov (USSR Academy of Sciences, Moscow) and R. Ryndin and J. Smorodinsky (Joint Inst. of Nuclear Research). Nuclear Phys. 3, 436-45 (1957) May.

The problem of the number of experiments which are necessary for the determination of the elements of the elastic scattering matrix is discussed. It is shown that in virtue of the unitarity condition the required number of experiments equals the number of complex functions entering the scattering matrix. In the case of nucleon-nucleon scattering the elastic scattering matrix can be determined on basis of 5 experiments: measurement of the cross section, polarization, normal component of the polarization correlation tensor and the normal components of the triple scattering tensor (for both particles). It is shown that experiments with rotation of polarization by the external magnetic field are not necessary for phase-shift analysis. (auth)

8209

DIFFUSE-SURFACE OPTICAL MODEL ANALYSIS OF ELASTIC SCATTERING OF 17- AND 31.5-Mev PROTONS. Michel A. Melkanoff, John S. Nodvik, and David S. Saxon (Univ. of California, Los Angeles) and Roger D. Woods (Univ. of Miami, Coral Gables, Fla.). Phys. Rev. 106, 793-801(1957) May 15.

Differential cross sections for the elastic scattering of 17- and 31.5-Mev protons by various nuclei have been analyzed according to the diffuse-surface optical model of the nucleus using a central interaction potential of the form $-(V + iW)/\{1 + \exp[(r-R)/a]\}$. Calculated curves of the ratio of the differential to the Rutherford cross sections are presented and compared with experimental values. The adopted values of the four parameters of the model are those which either give best agreement with experiment or, insofar as ambiguities exist, permit the interaction radius R to be expressed as $R_0A^{1/3}$ with R_0 constant throughout most of the periodic table. The average values of the parameters chosen in this way were found at 17 Mev to be as follows: real part of the nuclear potential V = 47 Mev, imaginary part of the nuclear potential W = 8.5 Mev, nuclear radius constant $R_0 = 1.33 \times 10^{-13}$ cm, surface rounding parameter $a = 0.5 \times 10^{-13}$ cm. A similar analysis at 31.5 Mev gave V = 35.5 Mev, W = 15.5 Mev, $R_0 = 1.33 \times 10^{-13}$ cm, $a = 0.55 \times 10^{-13}$ cm. Ambiguities in the quoted values due to compensating effects of changes in V and R_0 are discussed. For intermediate and heavy nuclei like Ag and Pt, good agreement can be obtained at 17 Mev for values of R_0 ranging from 1.2 to 1.4×10^{-13} cm, but for lighter elements like Co the range of R_0 is much more restricted. Theoretical curves of the reaction cross section are presented at 17 and 31.5 Mev based on quoted values of the model parameters. It is pointed out that accurate experimental measurements of this quantity may possibly resolve the ambiguity. (auth)

8210

THE ELASTIC AND INELASTIC SCATTERING OF PROTONS BY Mg. G. W. Greenlees, B. C. Haywood, L. G. Kuo, and M. Petravić (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) A70, 331-6(1957) May.

Absolute differential cross sections are given for the elastic scattering by Mg of protons of energies 9.55, 9.13, 8.83, 8.62 and 7.86 Mev, for an angular range of 25 to 165° (center-of-mass coordinates). The angular distributions show characteristic maxima and minima due to nuclear interference with Coulomb scattering. Absolute differential cross sections for the inelastic scattering of protons at these five energies from the 1.37-Mev level of Mg^{24} are also given. A marked variation of the angular distribution with energy has been noted. (auth)

8211

INCOHERENT SCATTERING OF GAMMA RAYS FROM THE BOUND ELECTRONS OF HEAVY ELEMENTS. J. Randles (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) A70, 337-47(1957) May.

In the experimental study of the coherent (elastic) scattering of gamma rays of energy greater than 1 Mev from the electrons of heavy atoms, the energy resolution of the available detecting instruments makes it impossible to distinguish between photons scattered coherently and those scattered incoherently with an energy loss of up to about 10%. The experimental results therefore include an unknown amount of incoherent scattering, the contribution of which is calculated in this paper. The answer is stated as the ratio of incoherent to coherent cross sections which is observed with a detector with the type of response to radiation assumed in the text, and the derivation is valid for large angles ($\gtrsim 60°$) and the energies of interest ($\simeq 1$ Mev). Since the method of solutions is much clearer in non-relativistic quantum mechanics, the necessary details are presented within this framework and at the end the procedure for the more exact relativistic theory is outlined. As will be seen, the ratio of the cross sections for tin is given well by the non-relativistic approximation although the absolute cross section is not. For heavier elements (e.g. mercury), only the relativistic theory is acceptable. (auth)

8212

THE SCATTERING OF FAST CHARGED PARTICLES. II. ON THE SINGLE SCATTERING OF 9.8 Mev POSITRONS IN XENON. K. R. Allen, E. A. Finlay, M. Lipsicas, D. Major, and K. Phillips (Metropolitan-Vickers Electrical Co. Ltd., Manchester). Proc. Phys. Soc. (London) A70, 355-60(1957) May.

The scattering of 9.8-Mev positrons in xenon in the angular interval 5 to 40° has been investigated using the cloud chamber method. The results agree reasonably well in this angular interval with the calculations of McKinley and Feshbach, in which Z is replaced by $-Z$. The ratio e^-/e^+ using the previous electron scattering results (Part I), normalized to 9.8 Mev, also agree well with McKinley and Feshback in the 5 to 30° interval. (auth)

8213

POLARIZATION OF Gev PROTONS SCATTERED BY COMPLEX NUCLEI. G. E. Brown (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) A70, 361-8(1957) May.

Polarization in the elastic scattering of Bev protons by carbon is calculated, assuming a model in which the nucleus is replaced by a complex spin-dependent phenomenological potential $V(r) = V_1(r) + \sigma \cdot LV_2(r)$. Results are compared with Birmingham experiments. In order to set the parameters of V_1, a new derivation, valid for high energies, of the relationship between the phenomenological potential and the nucleon–nucleon scattering amplitudes is given.

The results of the comparison with experiment are: (i) V_2 is mainly real, (ii) the same V_2 as was used at 300 Mev can explain experiments at 1 Bev. (auth)

8214

THE EFFECTIVENESS OF VARIATIONAL METHODS FOR INELASTIC SCATTERING PROBLEMS. R. J. Huck (Univ. Coll. London and Battersea Polytechnic). Proc. Phys. Soc. (London) A70, 369-80(1957) May.

The calculation of a partial cross section in atomic collision theory requires the solution of a pair of coupled integro-differential equations when the collision is inelastic and there is a possibility of particle exchange. A discussion is given of some variational procedures available for obtaining approximate solutions of such equations. These procedures are applied to the solution of two sets of model equations which simulate the equations of real problems but permit of exact solution. A comparison of exact and variational solutions enables the effectiveness of the variational methods to be assessed. It is found that a good approximation may be expected when trial functions are used which allow for the mixing of inelastically and elastically scattered waves, but that if only crude trial functions are used the approximation will be poor in cases where coupling is strong. (auth)

RADIATION EFFECTS

8215 NP-6322

Admiral Corp., Chicago.

THE EFFECTS OF NUCLEAR RADIATION ON ELECTRONIC COMPONENTS. PHASE 1. Scientific Report No. 7. Apr. 1, 1957. 507p. Contract AF33(616)-3091.

A variety of electronic components were tested before, during and after exposure to nuclear radiation. The irradiation facilities included the CP-5 reactor, where most of the irradiations were performed, the MTR, and a Co^{60} facility. The components, some of which were under normal operating conditions, were irradiated for several days. The radiation environment varied considerably, but typical values for the CP-5 were 2×10^6 r/hr for gammas, 5×10^9 epi-Cd neutrons/(cm^2sec) and 10^{12} thermal neutrons/(cm^2sec). Electron tubes tested consisted of the following: 2C40, 2K50, 3JP12, 371-B, 5703, 5719, and 6198. The 2C40 UHF triode showed some change in plate current in-pile. Five of the six active tubes survived post irradiation. The 2K50 thermally tuned klystrons failed in-pile; post irradiation tests indicated glass-to-metal seal fractures. Both 3JP12 cathode ray tubes survived irradiation, some envelope discoloring occurred. All of the 371-B high vacuum half wave rectifiers failed in-pile. The 5719 and 5703 subminiature triodes increased in plate current and transconductance and, in some instances, grid current. Both 6198 vidicon camera tubes failed in-pile, each displaying envelope fractures in post testing. The 1N58 germanium crystal diodes failed during irradiation. Every fixed mica, capacitor, with the exception of the CM35C622J, remained within tolerance in-pile; these decreased twelve percent from their initial value. In several instances the RN style, one and two percent, deposited film resistors exceeded their specified resistance tolerance in-pile. The RW wire wound power type resistors, in general, remained stable during irradiation; the resistance stability appeared largely dependent on manufacturer. Potentiometers–RV4NATSG501B also varied with manufacturer, showing as much as 30 percent change in-pile. Printed circuit boards of five basic materials were tested; glass epoxy, glass melamine, nylon phenolic, paper phenolic, and teflon. No evidence of permanent damage was indicated. In-pile change in leakage resistance of the boards are believed to be caused by temperature and a radiation-induced current carrier phenomenon. (auth)

8216

IRRADIATION DAMAGE IN SINGLE CRYSTALS OF MAGNESIUM OXIDE. F. P. Clarke (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 607-27 (1957) May.

Single crystals of magnesium oxide have been subjected to ultra-violet, x, and neutron irradiation. The bands produced by these radiations, their optical and thermal bleaching and associated luminescence are discussed. Taking into account the data of other workers, schemes for ultra-violet activation and luminescence are proposed. The ultra-violet activation is attributed to the freeing of positive holes, perhaps with exciton formation as an intermediary process, and the subsequent trapping of both electrons and positive holes at negative and positive ion vacancies. The role of the various impurities is discussed and it is concluded that they do not directly give rise to the optical absorption bands observed. The luminescence scheme assumes an optical band width of over 7.0 ev. It is then shown that the various luminescence photon energies correspond to values which are to be expected on the assumption that the optical absorption energies represent the heights of bands measured from the top of the valence band. (auth)

8217

ELECTRON-BOMBARDMENT-INDUCED DISSOCIATION OF ALKALINE EARTH OXIDES. P. Wargo and W. G. Shepherd (Univ. of Minnesota, Minneapolis). Phys. Rev. 106, 694-703(1957) May 15.

The oxygen evolution induced by electron bombardment of alkaline earth oxides has been directly observed by means of an omegatron mass spectrometer. Threshold energies for the process have been determined as 9.5 ± 0.5 ev, 140 ± 0.5 ev, and 16.9 ± 0.5 ev for BaO, SrO, and MgO, respectively. It is found that the efficiency of the process is in all cases proportional to the square of the current density at the target. It is suggested that a two-step electron excitation in the solid is involved. In the case of SrO, the use of a radioactive isotope of strontium provided a monitor for the release of the metal from the target. The energy dependence of the evolution of oxygen and strontium suggests that there are two processes, one predominating at low energies and the other at higher energies. An evolution of oxygen at a threshold energy of approximately 5 ev was observed for a variety of targets. The behavior of this evolution suggested that a desorption process was involved. (auth)

RADIOACTIVITY

8218

Zn^{65} γ RADIATION. B. S. L[illegible]elepov, V. P. Prikhodtseva, et al. (Khlopin Radium Inst., [illegible]ad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1359-60(1956) Dec. (In Russian)

Attempts were made to determine the ratio for Zn^{65} γ radiation and annihilation intensities and to find γ rays in the energies of 210 and 1370 kev using a γ spectrometer with electron recoil (ritron) and new experimental conditions. A diagram is presented showing the Zn^{65} spectrum with background deduction; the background in the vicinity of 511 kev is 25% and 0.1% at 1122 kev. An enlarged spectral area with the annihilation line is shown. The peak line analysis of intensity relations produced the value of (6.54 ± 0.5) × 10^{-2}; the analysis of the plane lines gave the value of (6.80 × 0.5) × 10^{-2}. The (γ511)/(γ1122)·(6.70 × 0.5) × 10^{-2} was accepted. Gamma energies of 210 and 1370 kev have

been found. A table of theoretical values for conversion coefficients derived by the interpolation of Rose data for Z = 29 and E = 1122 kev is presented. (R.V.J.)

8219

As^{76} γ SPECTRUM. APPARATUS. B. S. Dzhelepov, V. P. Prikhodtseva, et al. (Klopin Radium Inst., Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1361-4 (1956) Dec. (In Russian)

An analysis of the As^{76} γ spectrum was made with an improved ritron. The apparatus was re-calibrated for energies (with accuracy up to 1%) along the known γ lines of 190 kev In^{114}, 279 kev Hg^{203}, 412 kev Au^{198}, 511 kev Cu^{64}, 661 kev Cs, 1122 kev Zn^{65}, 1171 and 1331 kev Co^{60}, 597 and 1691 kev Sc^{124}, and 1380 and 2760 kev Na^{24}. The As^{76} γ spectrum was measured under operating conditions and a diagram of the spectrum with deductions for background effects is included. The line under 562 kev was 0.7% of the effect and under 2085 kev it was 0.2%. An enlarged portion of the diagram shows the hardest part of the As^{76} γ-ray spectrum. A table of As^{76} γ-line energies and intensities is presented. (R.V.J.)

8220

EFFECTS OF NUCLEAR CHARGE DISTRIBUTION ON THE ANGULAR CORRELATION IN β DECAY. A. Z. Dolginov and I. N. Toptygin (Leningrad Inst. of Physics in Technology, Acad. of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1377-85(1956) Dec. (In Russian)

The uniform nuclear space charge and nuclear surface charge were analyzed. It was found that β-γ correlation for these extreme cases can differ up to ~ 20%. Alterations in the assumed nuclear radius would cause the change in angular correlation and the inaccuracies in the radius may in turn disguise the nature of the charge distribution. The Tm^{170} nucleus whose moments and even parity levels are known has been selected for studies of β decay theory. (R.V.J.)

8221

THE DECAY SCHEME OF Ne^{23}. V. M. Ovchinnikov, Yu. A. Nemilov et al. Izvest Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1417-18(1956) Dec. (In Russian)

Investigations of the Ne^{23} (T = 40.2 sec) γ spectrum were made with a scintillation spectrometer. A γ line was found at 440 kev, and the top limit of intensities did not exceed 2% of the line intensity. (R.V.J.)

8222

A SEARCH FOR NATURAL RADIOACTIVITY IN VANADIUM. R. N. Glover and E. E. Watt (Univ., Glasgow). Phil. Mag. (8) 2, 697-9(1957) May.

No α nor β activity was detected. Comparison of the γ half life with the lower limit attainable in the proportional counter search for K x rays shows the impossibility of detecting these x rays using a thick source of unenriched material. It is estimated that if the search for x rays was carried out using a minimum of 250 mg of vanadium pentoxide, 50 times enriched in V^{50}, then a significant count rate should be obtained. (M.H.R.)

8223

A SEARCH FOR ELECTRON CAPTURE IN ^{176}Lu. R. N. Glover and D. E. Watt (Univ., Glasgow). Phil. Mag. (8) 2, 699-702(1957) May.

It is concluded that there is no evidence of γ rays or conversion electrons which could be associated with an electron capture branch and that the branching ratio of (3 + 1)% previously proposed might rather be regarded as an upper limit. There appears to be a marked disagreement between the half lives reported from γ and β measurements. The high α rates found often indicate contamination, either β or γ, hence the half life calculated in this investigation cannot be considered significant. (M.H.R.)

8224

THE WEAK LINES IN THE RADIUM D GAMMA SPECTRUM. A. C. L. Barnard and B. C. Haywood (Univ. of Birmingham, Eng.). Phil. Mag. (8) 2, 713-16(1957) May.

The literature on the weak lines in the Pb^{210} gamma spectrum is reviewed. Since in this literature the chemical form of the source and the chemical separation procedures are frequently inadequately described, it is suggested that these lines may arise from fluorescence of impurities or chemical components in the source. (M.H.R.)

8225

DECAY OF Hf^{181}. Evan S. Snyder and Sherman Frankel (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 106, 755-64(1957) May 15.

The decay of Hf^{181} to Ta^{181} was studied by angular correlation measurements (133 K−482γ, 133γ−482γ, and 133γ−482 K, energies being given in kev), conversion coefficient measurements [$\alpha_K(133) = 0.50 \pm 0.06$, $\alpha_K(136) = 1.2 \pm 0.2$, $\alpha_K(346) = 0.038 \pm 0.007$, $\alpha_K(482) = 0.023 \pm 0.002$], K/L ratios, and coincidence measurements. The weak 137-kev transition, first observed by Mihelich, was placed in the decay by delayed coincidence measurements. The spin assignments are in excellent agreement with the calculations of Nilsson on the strong-coupling model. Comparison of K−γ and γ−γ correlation coefficients in the HfO_2 sources fails to show any after effects of K-hole formation on the correlation coefficients. The discrepancy between the E2/M1 ratio obtained from γ−γ correlation measurements and conversion coefficient measurements in the 482-kev transition is discussed in terms of the improved finite nuclear size corrections to M1 conversion coefficients described by Church and Weneser. (auth)

8226

RADIATIONS FROM W^{185} AND W^{187}. V. S. Dubey, C. E. Mandeville, Ambuj Mukerji, and V. R. Potnis (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 106, 785-90(1957) May 15.

The radiations of W^{185} and W^{187} have been examined in a thin-lens magnetic spectrometer, by coincident scintillation spectrometers, and with a gray-wedge analyzer. W^{185} was found to emit no detectable gamma rays. Its beta spectrum is first-forbidden (ΔI = 1, yes!) and of maximum energy 440 ± 5 kev. By observation of internal conversion lines and photoelectric peaks, fourteen gamma rays have been resolved in the decay of W^{187}. Three beta-ray spectra are emitted with end-point energies of 340 ± 20, 630 ± 10, and 1325 ± 15 kev with relative intensities of 10%, 70%, and 20%. The most energetic spectrum has the unique shape associated with a spin change of two and a change of parity. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

8227

LIFETIME OF EXCITED STATES OF RARE EARTHS. E. E. Berlovich (Leningrad Inst. of Physics in Technology, Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1438-50(1956) Dec. (In Russian)

Radiation transition probabilities were determined by measuring the lifetime of excited states using the method of delayed coincidences. Effects of the pulse fronts on the shapes of coincidence curves are discussed and coincidence curves between Au^{198} β particles and γ quanta of Hg^{198} transitions at 411 kev are given. The β spectrum and all Compton distributions are recorded in their entirety and also, as β spectrum and Compton distribution equivalent energy areas. Investigations were made of Eu^{152} and Eu^{154}

decay schemes and lifetimes on the first level of Sm^{152} at 122 kev, Gd^{152} at 344 kev, and Gd^{154} at 123 kev. Diagrams of the Er^{166} lifetime at 81 kev, the e-β coincidence for $Ho^{166} \rightarrow Er^{166}$, as well as the lifetime of Hf^{177} at 133 kev, and e-β coincidence for $Lu^{177} \rightarrow Hf^{177}$ are included. Data for investigated levels of Pr^{141}, Sm^{152}, Gd^{152}, Gd^{154}, Er^{166}, and Hf^{177} are presented. (R.V.J.)

8228

THE ATOMIC HEAT OF CERIUM BETWEEN 1.5° AND 20°K. D. H. Parkinson and L. M. Roberts (Radar Research Establishment, Great Malvern, Worcs.). Proc. Phys. Soc. (London) B70, 471-5(1957) May.

The specific heat of specimen of cerium of face-centered cubic structure has been measured between 1.5° and 20°K and anomalous effects, expected as a result of the susceptibility measurements of Lock, have been found. The specific heat shows a marked maximum at 12.5°K, the magnitude of which increases with the number of times the specimen has been cooled. The anomaly is probably due to antiferromagnetism. (auth)

8229

PARAMAGNETIC RESONANCE ADSORPTION IN GADOLINIUM TRICHLORIDE. C. A. Hutchison, Jr., B. R. Judd, and D. F. D. Pope (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) B70, 514-20(1957) May.

The paramagnetic resonance spectrum in crystals of $GdCl_3$ diluted with $LaCl_3$ and $CeCl_3$ has been examined. The splitting of the ground level $^8S_{7/2}$ of Gd^{3+} in zero magnetic field is small, and has a remarkable temperature dependence. A theory to account for the experimental results is developed, and it is shown that perturbation mechanisms both linear and quadratic in the crystalline field potential are important. (auth)

SHIELDING

8230 AERE-RS/L-3A

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME WORKED EXAMPLES IN RADIATION SHIELDING. C. C. Horton. Apr. 18, 1955. 10p.

Solutions of three typical radiation shielding problems are given in full. (M.H.R.)

8231 APAE-Memo-98

Alco Products, Inc., Schenectady, N. Y.

SHIELDING CALCULATIONS FOR APPR-1 DEMINERALIZER SHIPPING CONTAINERS. R. C. DeYoung. Apr. 26, 1957. 7p. Contract [AT(11-1)-318]. $1.80(ph OTS); $1.80(mf OTS).

Calculations were performed which indicate the required lead thickness to adequately shield an APPR-1 demineralizer during transfer in 3.5 inches. (D.E.B.)

8232 UCRL-3477

California. Univ., Berkeley. Radiation Lab.

A GRAPHIC SOLUTION FOR GAMMA SHIELDING. William G. Ruehle, Jr. July 24, 1956. 16p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

An equation for calculating gamma radiation through shielding is derived, which is applicable to practical monitoring and equipment-design problems. A graphic solution of the equation is included, as well as examples of its use and tables of values for specific conditions. (auth)

SPECTROSCOPY

8233 AEC-tr-2724

CONCERNING THE SPECTRA OF SYSTEMS OF INTERACTING PARTICLES. Yu. L. Klimontovich and V. P. Silin. Translated from Zhur. Eksptl.' i Teoret. Fiz. 23, 151-60(1952). 13p.

An equation is derived for the quantum distribution function, which is a generalization of a well known classical equation. With the aid of this equation, the excitation (vibration) spectra of macroscopic systems of interacting particles is investigated. The quantum dispersion equation is found, which connects the frequency and the logarithmic decrement of damping with the vibration wave vector for such systems. For negligible damping the vibration spectra of degenerate Bose and Fermi systems with central forces is obtained. The case of magnetic interaction between particles is analyzed. (auth)

8234 AEC-tr-2737

A LOW PRESSURE MERCURY LAMP FOR THE STUDY OF RAMAN SPECTRA. M. L. Sosinskii (Sosinsky). Translated from Izvest. Akad. Nauk S.S.S.R., Ser Fiz. 18, 709-10 (1954). 3p.

Diagrams are given for a low-pressure lamp which is capable of prolonged operation. Some data are included on its use for the study of Raman spectra. (B.J.H.)

8235

CONTRIBUTIONS OF OPTICAL METHODS TO NUCLEAR PHYSICS. G. Breit (Yale Univ., New Haven, Conn.). J. Opt. Soc. Amer. 47, 446-59(1957) June.

A general review of developments in nuclear physics which have resulted from the application of optical methods to the study of nuclei is given. Some related developments which have resulted from applications of atomic beams which have been stimulated by the early spectroscopic ideas as well as by the results of spectroscopic research are discussed. Some items under consideration are: coupling of electron system to nuclear spin, the electron-nuclear volume and shape effect, the hyperfine structure of the isotopes of hydrogen, distribution of nuclear magnetic, isotope shift and quadrupole moments, bearing of latter on nuclear models. (auth)

8236

PHOTOGRAPHIC ION DETECTION IN MASS SPECTROSCOPY. E. Schönheit. Naturwissenschaften 44, No. 9, 278-9(1957). (In German)

THEORETICAL PHYSICS

8237

A GENERALIZED PROBLEM ON THE STOCHASTIC MOTION OF PARTICLES. N. A. Chernikov (Inst. of Combined Nuclear Research, Lab. of Theoretical Physics). Doklady Akad. Nauk S S.S.R. 112, 1030-2(1957) Feb. 21. (In Russian)

8238

FERMI FIELDS AND SPINORS OF INFINITE SPACE. Yu. A. Gol'fand (Lebedev Inst. of Physics, Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 113, 68-70(1957) Mar. 1.

The development of functional methods in quantum field theory reduced the problem of determining the propagation function of interacting particles to the simpler problem of determining the propagation function of fermions in motion in the arbitrary outer field of corresponding Bose particles, and to subsequent functional integration according to the outer field. However, mathematical complications prevented practical application of the method. A new aspect of the problem revealing a sudden unexpected connection between Fermi field theory and the infinite space spinor theory are discussed. (R.V.J.)

8239

ON THE ROLE OF PSEUDOSCALAR INTERACTION VARI-

ATIONS IN β DECAY THEORY. L. N. Zyryanova (Leningrad Zhdanov State Univ., Research Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1399-1406(1956) Dec. (In Russian)

Certain deductions for the role of P variation in β decay were derived on the basis of shape analysis in forbidden β decay spectra. The 0-0 transitions with parity alterations were analyzed to determine the presence of P interactions in the general β-decay law. Beta spectra connected to the transitions between the basic levels of $Pr^{144}-Nd^{144}$, and $Tl^{206}-Pb^{206}$ nuclei, were investigated. Decay schemes and experimental spectra for Pr^{144} and Tl^{206} are presented. The tables of β electron functions necessary for shape analysis of Pr^{144} and Tl^{206} spectra were developed. (R.V.J.)

8240

THE PROBLEM OF AN EFFECTIVE MASS IN NUCLEAR MATTER. Victor F. Weisskopf (Massachusetts Inst. of Tech., Cambridge). Nuclear Phys. 3, 423-32(1957) May.

It is shown that the existence of nuclear matter and the independent particle description of its properties implies by itself that the average potential energy is momentum dependent. If this momentum dependence is expressed in terms of an effective mass m^*, one gets $m/m^* = {}^3/_2 + ({}^5/_2)(P/T_f)$, where P is the packing fraction and T_f the Fermi kinetic energy. The Van Vleck calculation of the average potential energy in the independent particle model is discussed as an example. The photonuclear effect is discussed in terms of a velocity dependent potential. (auth)

8241

THE DIPOLE SUM RULE WITH AN APPROXIMATE HAMILTONIAN. J. S. Levinger (Louisiana State Univ., Baton Rouge), N. Austern (Univ. of Pittsburgh, Penna.) and P. Morrison (Cornell Univ., Ithaca, N. Y.). Nuclear Phys. 3 456-64(1957) May.

The familiar f sum rule for the electric dipole interaction of a complex charge-current system with the electromagnetic field is known to be simply applicable even when exchange forces and other non-classical dynamical effects are present. Evaluation of the f sum for absorption from the ground state can be made knowing only the Hamiltonian and the ground state wave function. For complex systems the exact wave function is rarely known. Two methods of estimating the f sum are then attractive whenever an independent particle model is empirically favored: use of the best IPM wave functions and the true Hamiltonian, or use of the same wave functions but the equivalent one-body potential found to give best energy levels for the IPM. In the first calculation, dynamical correlations are neglected; in the second, a spurious contribution to the sum arises from the velocity dependent form typical of an equivalent one-body potential. The f sum is computed by both methods in a nuclear example. The results show the differences of principle which arise, though the numerical agreement is rather close. Physical arguments are given for the origin of this close agreement, which can be expected only in particular cases. No criterion for the reliability of such IPM sum rule calculations is known. (auth)

8242

ON THE RELATIONSHIP OF DYNAMIC AND STATISTICAL REGULARITIES IN ATOMIC PHENOMENA. S. V. Vonsovskiĭ and G. A. Kursanov. Vestnik Akad. Nauk S.S.S.R. 27, No. 4, 31-45(1957) Apr. (In Russian)

8243

INTRODUCTORY REMARKS ON MESON THEORY. Hideki Yukawa (Kyoto Univ., Japan). Revs. Mod. Phys. 29, 213-15 (1957) Apr.

Progress in meson theory is reviewed. Various problems confronting the theory are discussed and possible interpretations offered. (M.H.R.)

8244

EFFECTS OF COULOMB FIELD SHIELDING BY FREE CHARGES IN METALS AND SEMICONDUCTORS. I. Z. Fisher (Minsk Belorusskiĭ Univ.). Zhur. Tekh Fiz. 27, 638-50(1957) Apr. (In Russian)

The basic physical effects in metals and semiconductors were investigated, based on the formal theory of bound states in a partially shielded Coulomb field developed by the above author (Zhur. Tekh. Fiz. 27, No. 6 (1957)). It has been found that in most cases practical applications of the formal theory demanded additional analysis of the shielded field fluctuations and the associated fluctuations of the bound electron (hole) states. (R.V.J.)

8245

THE RELATION OF ELECTRON TEMPERATURE DETERMINATION BY LANGMUIR PROBE CHARACTERISTICS AND BY THE METHOD OF TWO PROBES. V. I. Tverdokhlebov (Artem Dnepropetrovskiĭ Mining Inst.). Zhur. Tekh. Fiz. 27, 753-5(1957) Apr. (In Russian)

A formula for electron temperature was further developed to determine the electron temperatures by Langmuir probe characteristics and by the method of two probes. (tr-auth)

URANIUM AND URANIUM COMPOUNDS

8246 ANL-5700(Pt. B)

Argonne National Lab., Lemont, Ill.

THE ELECTRICAL CONDUCTIVITY OF URANIUM. Karl F. Smith. Apr. 1957. 25p. Contract W-31-109-eng-38. $0.25(OTS).

Second in a monograph series on "The Physical Metallurgy of Uranium," sponsored by the Metallurgy Div., ANL.

The data on electrical conductivity of U, including the British work on purity, a study of transition temperature effects, and other more unusual points, like the effects of annealing temperature, cycling growth, preferred orientation, and hydrostatic pressure are presented. Comments in the literature on superconductivity of U are also covered. The reason for classing as minor the effects of preferred orientation is that the electrical-thermal relations apparently may not be valid for different crystallographic directions and so cannot as yet be used to determine thermal data. The monograph is primarily intended as a critical review of data to be used for further research on U, and completeness has been striven for only in the one respect of published data on U. A brief résumé of basic theory not intended to be complete, is included along with some schematic description of apparatus and experimental techniques. Electrical measurements, not being so difficult or so demanding in experimental technique, usually have an earlier history than thermal measurements of a given substance. The spread of data from various observers occurs over a much narrower band than the thermal data, even if observations be limited to U of nominal purity. The best and most representative data at the present time are shown for resistivity and translated to conductivity. (auth)

8247

THE FISSION OF URANIUM WITH EMISSION OF THREE FAST PARTICLES. N. A. Perfilov, V. P. Shamov, and O. V. Lozhkin (Radium Inst. Acad. of Sciences U.S.S.R.) Doklady Akad. Nauk S.S.S.R. 113, 75-7(1957) Mar. 1. (In Russian)

Several cases of U fission accompanied by multicharged particles with $Z \geq 4$ charge were observed on plates saturated with U and irradiated by 660-Mev protons. A flat tri-prong event was observed during the experiment. According to their appearance (density of the grain, presence of δ-nuclei on two of the tracks) the tracks of all three

particles forming the fork should be multicharged particles: two of them were considered the fission fragments of a heavy nucleus, while the density of the third exceeded the tracks of α particles. The analysis of the tracks confirmed that the tri-pronged event was the result of uranium fission with low initial excitation energy. It is suggested that a study of all cases of U fission with multicharged particles should produce a more accurate answer to the reaction processes of this type. (R.V.J.)

PATENTS

CHEMISTRY

8248

METHOD AND APPARATUS FOR OBTAINING DUCTILE TITANIUM OR ZIRCONIUM. K. M. Hill (to Peter Spence and Sons, Ltd.). British Patent 768,124. Nuclear Eng. 2, 266(1957) June.

Halide reduction is normally carried out in two separate stages. In the second stage the contaminating halide and unreacting reducing metal are removed by leaching with liquid NH_3 or acid or by distilling in vacuo. In both methods contamination risks are present affecting the purity and hardness of the Ti or Zr. The new apparatus enables the reaction and subsequent distillation to be carried out as a single operation allowing unobstructed path distillation to take place from the evaporating surface to the condensing surface. It is built up, in general, of a reaction vessel, an inverted condensing vessel mounted on the reaction vessel, with temperature control and evacuating means and with inverting means for the reaction and condensing vessels so as to enable interchange of their relative positions. (auth)

8249

TREATMENT OF POLYTETRAFLUORETHYLENE. A. Charlesby (to U. K. Atomic Energy Authority). British Patent 768,554. Nuclear Eng. 2, 266(1957) June.

Polytetrafluorethylene is subjected to irradiation with ionizing radiations (in a thermal nuclear reactor) equivalent to from two to 13 units (15×10^5 r). The substance (sheet, rod, granules or powder) may then be molded at 200°C or less, dependent on the radiation dose. (auth)

8250

RECOVERY OF URANIUM VALUES. R. E. Stedman (to I.C.I. Ltd.). British Patent 768,946. Nuclear Eng. 2, 266 (1957) June.

This refers to the recovery of U values from reaction mixtures obtained by opening up rock phosphate with a reactant comprising a mineral acid in which the acid radicals are at least stoichiometrically equivalent to the phosphate and other constituents decomposable by the reactant. The reaction mixture is neutralized and undissolved material separated. From the liquid a phosphate containing U salt is precipitated in the presence of a filter aid, the solid mixture is separated from the liquid and the mixture then treated with a mineral acid to dissolve the precipitated U salt from the filter aid. The solution produced is separated and treated for the precipitation of U values in concentrated form. (auth)

8251

PROCESS OF TREATING RADIOACTIVE LIQUIDS SO AS TO REDUCE THEIR RADIOACTIVITY. J. Bouchard (to L'Auxiliaire des Chemins de Fer et de l'Industrie). British Patent 769,121. Nuclear Eng. 2, 266(1957) June.

Rivers or entire stretches of water may become contaminated and dangerous due to the presence of naturally radioactive ions, or ions which have become radioactive by induction. Purification is only possible by extracting these ions. For this purpose ion exchangers have been used to which the contaminating ions could be fixed. These ion exchangers are characterized by high porosity and a large contact area. However, it has been found that the reduction in radioactivity is sometimes insufficient. Difficulties are avoided by associating with or substituting for the usual ion exchangers, ions selected first as a function with the nature of the radioactive ions to be eliminated (mostly heavy metal ions), so as to shift the exchange equilibrium in the direction of the maximum fixation of these radioactive ions and, secondly, so that the exchange ions are not prone to pass out in solution in the effluent liquid. The ions of non-radioactive heavy metals are those having an atomic weight in excess of 100 as, e.g., lead, barium, mercury, cadmium, silver, bismuth. The exchange may be carried out in two exchangers in series. The first contains the heavy metal ions, the second the usual ions. (auth)

PHYSICS

8252

FUEL ROD ASSEMBLIES FOR NUCLEAR REACTORS (to Atomic Energy of Canada Ltd.). British Patent 768,078. Nuclear Eng. 2, 266(1957) June.

In D_2O cooled nuclear reactors, cylindrical U rods are normally used encased in a tightly adherent sheath of Al. An outer tube spaced from the sheath serves for the passage of the coolant under pressure. The cylindrical form of the fuel rod was chosen in order to maintain tight contact between rod and sheath regardless of the expected deformation under irradiation to assure effective heat transfer. This arrangement, however, results in having the minimum cooling surface per unit of volume of fuel, and the neutron flux obtainable is limited by the maximum temperature which the fuel in the rods may be allowed to reach. A great increase in cooling surface can be obtained and consequently a corresponding higher neutron flux without increasing difficulties arising out of deformation or local overheating by an arrangement comprised of flat thin strips of varying widths, reinforced by ribs or otherwise against bending, placed parallel and spaced from each other in a tube. The fuel is tightly enclosed in the pliable sheaths of Al of a thickness of 0.04 in. for strips of 0.15 to 0.18 in. thickness. (auth)

8253

ION GENERATING APPARATUS. P. P. Starling (to U. K. Atomic Energy Authority). British Patent 769,291. Nuclear Eng. 2, 266(1957) June.

This patent refers to an apparatus (calutron) for separating isotopes. An ion source unit for such apparatus usually comprises an arc block with one or more arc chambers, in which the ions are generated by bombardment of the vapor of a substance with electrons emitted from a heated filament. The arc block operates at a high temperature and tends to become contaminated. Where the substance under treatment is valuable recovery may be necessary. An arc block formed largely or wholly of carbon (graphite) will undergo a minimum of dimensional changes, will be readily assembled on and removed from the unit and will allow ready recovery of contaminated substances. The block has at least one recess constituting an arc chamber with an orifice for the admission of electrons and it has an aperture for admission of the substance to be ionized. (auth)

8254

MASS ANALYSES OF IONS. J. A. Hipple (U.S.A.). British

Patent 769,450. Nuclear Eng. 2, 266(1957) June.

Heavy magnets used in conventional equipment are eliminated by an arrangement in which a series of impulses are applied to the periodically ionized mixture imparting to the ions energies proportional to their mass-to-charge ratios. A collecting electrode is maintained at a certain potential so that it repels all ions of energies less than that of those selected. (auth)

8255

ELECTRICAL PULSE SCALING CIRCUIT. E. H. Cooke-Yarborough (to U. K. Atomic Energy Authority). British Patent 769,704. Nuclear Eng. 2, 266(1957) June.

This scaling circuit has a common turn-off plate and a more economical number of elements than hitherto required. The elements have two characteristic stable states (conducting and non-conducting) and are arranged in a ring. Each element on changing from a first state to a second state causes the next element to change from the second state to the first state, and one element changes also the state of a further element. Pulses may be applied simultaneously to all elements and they may be reset to a starting condition at the end of each cycle. If four elements are used a scale up to 12 can be provided. Preferred in a scale of 10 for decimal counting. (auth)

8256

COMPUTING APPARATUS (to Schlumberger Well Surveying Corp. (U.S.A.)). British Patent 770,017. Nuclear Eng. 2, 266(1957) June.

An automatic computer capable of accommodating transposed functions is described. Successive values of an independent variable are plotted in terms of two co-ordinate values of another independent variable and a dependent variable. Instantaneous values of the dependent variable are rapidly determined as the values of the independent variables vary. (auth)